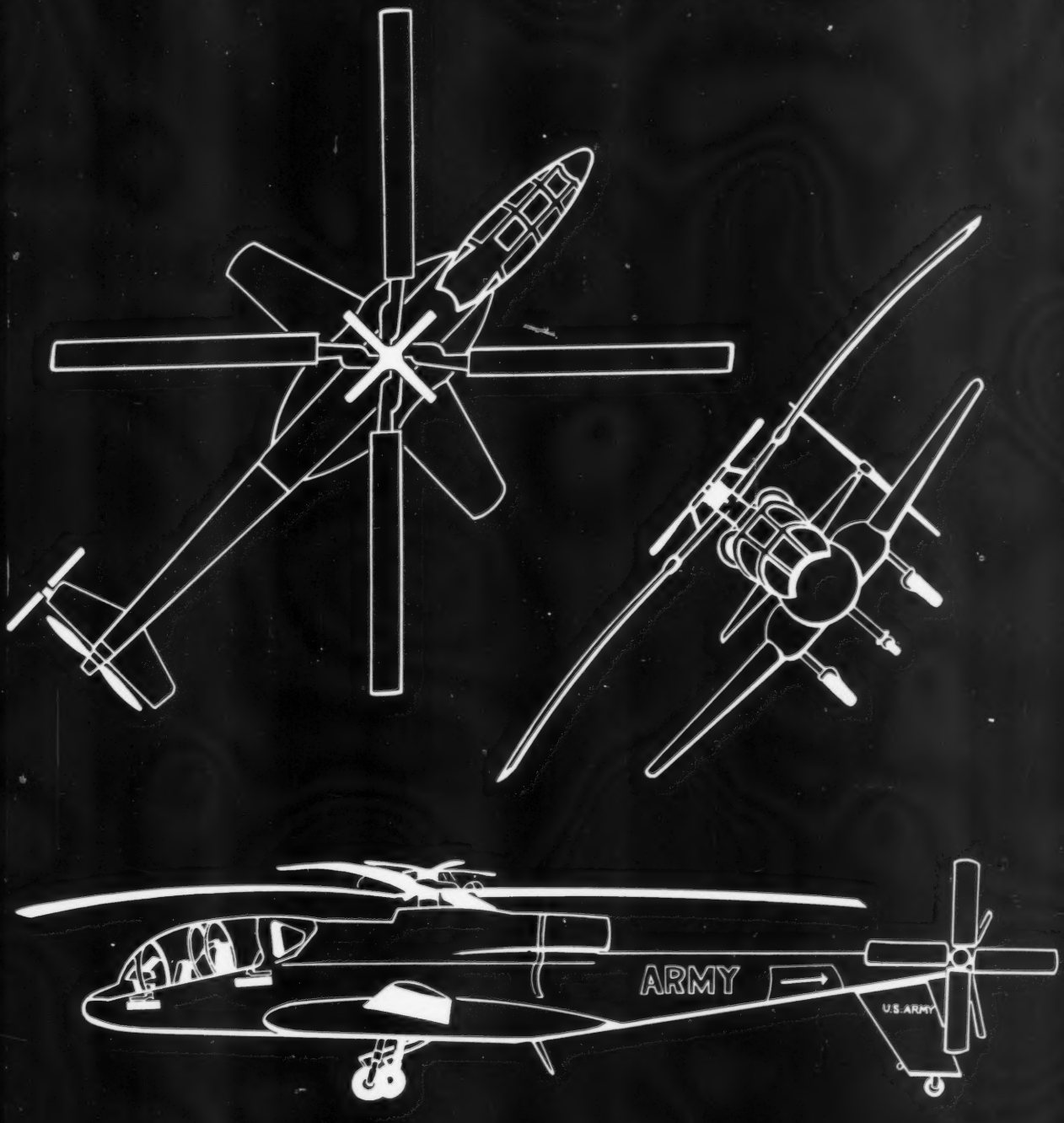
UNITED STATES ARMY

JANUARY 1968

AVIATION DIGEST



UNITED STATES ARMY AVIATION DIGEST

DIRECTOR OF ARMY AVIATION, ACSFOR
DEPARTMENT OF THE ARMY

COL Edwin L. Powell Jr.

COMMANDANT, U. S. ARMY AVIATION SCHOOL

MG Delk M. Oden

ASST COMDT, U. S. ARMY AVIATION SCHOOL

COL M. H. Parson

DIGEST EDITORIAL STAFF

MAJ L. J. Herman Jr., Editor-In-Chief
Richard K. Tierney, Editor
William H. Smith
Diana G. Williams
John P. Jones

GRAPHIC ART SUPPORT

Harold G. Linn
Harry A. Pickel
Dorothy L. Crowley
Angela A. Akin

DIRECTOR, U. S. ARMY BOARD FOR AVIATION
ACCIDENT RESEARCH

COL Warren R. Williams

USABAAR EDUCATION AND LITERATURE DIV

Pierce L. Wiggin, Chief
William E. Carter
Ted Kontos
Charles Mabius
Mary W. Windham

JANUARY 1968 VOLUME 14 NUMBER 1

LETTERS	1
THE CHEYENNE, LTC Emil E. Kluever	2
THE SHOWOFF, CPT Edward A. Janas	5
BIRD-DOGGING IN VIETNAM, CPT Walter H. Yates	8
ON TOP, CPT Vernon J. Mathern	10
PROFESSOR HACKETUS DISCUSSES BALLISTICS, LT Michel D. Caldwell	14
ONE FOR THE MONEY, MAJ John K. Ham	18
THE NEW LOH, LTC Frank E. Hearn, Jr.	24
SURPRISE! LTC Richard E. Mack	27
THE OLD COMES DOWN THE NEW WAY	31
HURRICANE BEULAH	32
SELLING THE EXOTICS IN CI OPERATIONS, LTC Donald P. Frandsen	34
CRASH SENSE	36
THE NICKEL-CADMIUM BATTERY MYSTERY	46
PEARL'S	50
VOICE WARNING SYSTEMS FOR ARMY AIRCRAFT LTC Clement A. Wyllie	58
THE GREEN BERETS	Back Cover

The mission of the U. S. ARMY AVIATION DIGEST is to provide information of an operational or functional nature concerning safety and aircraft accident prevention, training, maintenance, operations, research and development, aviation medicine, and other related data.

The DIGEST is an official Department of the Army periodical published monthly under the supervision of the Commandant, U. S. Army Aviation School. Views expressed herein are not necessarily those of Department of the Army or the U. S. Army Aviation School. Photos are U. S. Army unless otherwise specified. Material may be reprinted provided credit is given to the DIGEST and to the author, unless otherwise indicated.

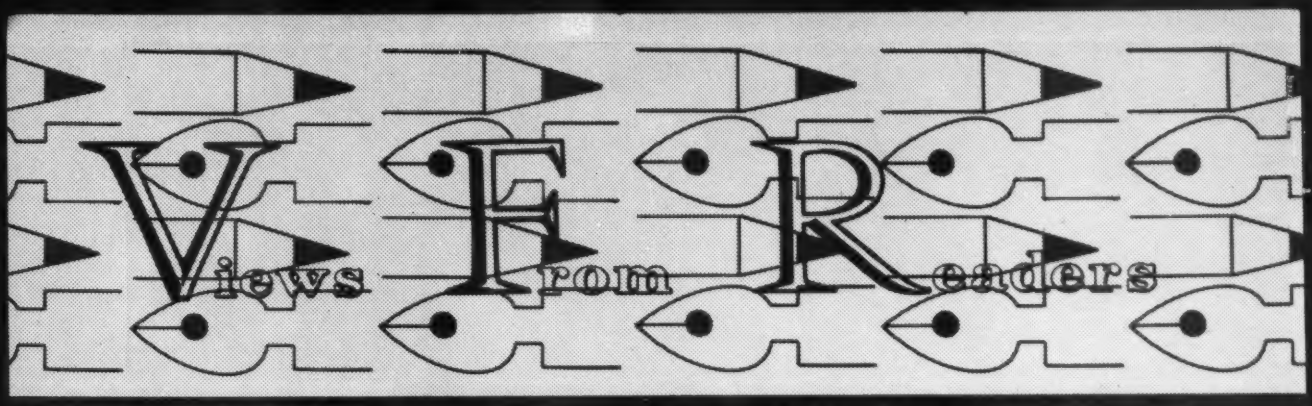
Articles, photos, and items of interest on Army Aviation are invited. Direct communication is authorized to: Editor-in-Chief, U. S. Army Aviation Digest, Fort Rucker, Alabama.

Use of funds for printing of this publication has been approved by Headquarters, Department of the Army, 3 November 1967.

Active Army units receive distribution under the pinpoint distribution system as outlined in AR 310-1, 20 March 62, and DA Circular 310-57, 14 March 63. Complete DA Form 12-4 and send directly to CO, AG Publications Center, 2800 Eastern Boulevard, Baltimore, Md. 21220. For any change in distribution requirements, merely initiate a revised DA Form 12-4.

National Guard and Army Reserve units submit requirements through their state adjutants general and U. S. Army Corps commanders respectively.

For those not eligible for official distribution or who desire personal copies of the DIGEST, paid subscriptions, $4.50 domestic and $5.50 overseas, are available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C., 20402.



Sir:

Captain Goldschmidt's article, "Don't Press the Panic Button," (Sep 67) illustrates a good point. The UH-1D can easily be flown, hovered, and parked without hydraulic assist.

Hydraulics off operation at a hover is not a flagrant violation of rules or an unauthorized flight maneuver. The —10 emergency procedure states: "4-32c, Airspeed—adjust as desired to obtain the most comfortable control movement level."

Some units in Vietnam teach hydraulics off takeoff, traffic pattern and landing from a hover. Newly arrived aviators have no trouble performing this maneuver. The confidence it instills in their ability to take off and land without hydraulic boost has resulted in the saving of several combat damaged aircraft. I recommend this procedure be adopted by the Aviation School in addition to running landings.

MAJ THOMAS W. WHEAT, JR.
14th Combat Aviation Bn
APO San Francisco 96355

• The Director of Instruction provided the following comments: "Hydraulics off operations have been discontinued at USAAVNS due to recent maintenance failures of the hydraulic system" and that your recommendation ". . . may be reconsidered when the maintenance difficulty is solved and when USAAVNS hydraulic off operations are continued in the training program."—The Editors

Sir:

Reference the article "Fog" which appeared in the October issue of the DIGEST.

Unfortunately there exists among Army aviators throughout the world a considerable degree of ignorance concerning the purpose, capabilities and limitations of the rotary wing tactical instrument training program.

In view of this ignorance I can fully understand how the "Fog" accident investigating board might arrive at the erroneous conclusion that a pilot's possession of a tactical instrument card resulted in overconfidence and therefore became a prime contributing factor to an accident.

What I cannot understand is why so respected a publication as the AVIATION DIGEST would propagate this unfortunate ignorance by publishing so undeserving an article as "Fog." In so doing the DIGEST has perpetrated a serious disservice to every tactical cardholder in that it has attempted to undermine the aviator's confidence in a portion of his training that is fully capable, and quite simply designed, to save his life.

LTC FREDERICK L. CLAPP
HQ, U. S. Army Element
APO New York 09224

• This article should in no way undermine the confidence of holders of tactical instrument certificates, provided they recognize their capabilities and limitations, and assume the responsibilities inherent to their tasks. **The fact that the aircraft commander in this accident did not recognize these factors was evidenced by:**

1. Failure to use available weather service.

2. Inadequate evaluation of existing weather. He thought he would be VFR, though he estimated horizontal visibility at takeoff as 50-75 meters.

3. Failure to set instruments before takeoff.

4. Attempt to fly instruments from left seat by referring to attitude indicator on the right side.

5. Failure to monitor altimeter and vertical speed indicator after going on instruments.

6. Aircraft commander's statement that he was overconfident.

The article also points out these contributing supervisory factors:

1. No current checkride.

2. No instrument or night flying checks since leaving school.

3. No night flying in the four months prior to the accident.

When these factors are considered, there can be little doubt that this aircraft commander was overconfident. According to the flight surgeon, who is best qualified to evaluate physiological and psychological factors, ". . . the possession of a tactical instrument certificate caused the aircraft commander to have a great deal of overconfidence in his abilities as an instrument pilot."

This article was designed to help holders of all instrument certificates by pointing out the pitfalls they may face if they do not fully recognize their capabilities, limitations, and responsibilities. There was no intent to single out the holders of tactical instrument tickets as being especially subject to overconfidence. Staff visits by USABAAR have confirmed your statement of a lack of understanding of the tactical instrument ticket.

—The Editors

Sir:

On page 31 of the November issue of the AVIATION DIGEST, the article titled "Foreign Legion" states that the "334th Armed Helicopter Company is the U. S. Army's only gunship company." This is in error.

The "Delta" companies of the 227th and the 229th Aviation Battalion (Assault Helicopter) of the 1st Air Cavalry Division have been organic "gunship companies" since their inception in the 11th Air Assault Division in 1964.

The officers and men of the two gunship companies would like to be recognized for their service in CONUS and in Vietnam.

MAJ JAMES M. STAMPER
Chief, Tng & Sched, DOMT
Fort Rucker, Ala. 36360

Sir:

Reference the article entitled "U-8F Landing — Gear Up!" in November 1967 issue of AVIATION DIGEST. See my article on the same subject published in your magazine in December 1962.

Captain Scott says in his last sentence, "However, in making the go-around, I forgot to lock mine."

He also forgot to smile. . . .

LTC FREDERICK B. WELLER
Dir, Flight Evaluation Div
Fort Wolters, Texas 76067

THE CHEYENNE

With its day and night target detection and weapons deployment capability, it will be the most versatile and potent aerial weapons system the Army has ever developed

Lieutenant Colonel Emil E. Kluever

YOU'RE wearing a dime-sized transparent "patch" over your right eye, about an inch away. Through this helmet-anchored patch you see a reticle ring of light, with a center dot, that seems to be part of a distant target.

From sources behind your head, rotating infrared light beams are directed to sensors on your helmet.

You merely glance at the target and preselected weapons on your aircraft turn at the same time, automatically pointed to whatever you see, aimed and ready to fire at your touch.

You're the pilot of the radically new AH-56A Cheyenne—the U. S. Army's high-performance aerial protector and the world's most advanced rotorcraft. You're wearing a helmet sight that is linked electronically to the aircraft's weapons. It was designed especially for this advanced aerial fire support system.

In front of you is the copilot/gunner. His computerized swiveling gunner's station can swing around in a complete 360° circle to enable him to search and track targets during flyby and rapidly fire upon them without requiring the pilot to shift his course. The gunner's station has a variable power periscope sight for detection, examination, tracking, and aiming; a laser range finder; and missile guidance sensors. The gunner can achieve a 12-power magnification of target. This means that from a 1½ mile distance, he could sight on an object as small as an automobile radiator cap. Only his targets are somewhat more deadly. When an enemy target is spotted, the gunner needs only to frame it in his sight and the range is determined instantly by the laser range finder.

You, the pilot, can also lock the swiveling gunner's station to your helmet sight to designate targets for the gunner, automatically pointing him and weapons toward the target location.

This is the flying and fighting Cheyenne of the future.

Now under development at the Lockheed-California Company, the Army AH-56A will "ride shotgun" for troop-carrying helicopters and provide fire support in combat landing zones. The Honeywell helmet sight and the General Electric swiveling gunner's station being built under Lockheed direction help make the AH-56A the most effective combat rotorcraft ever conceived for direct fire support and helicopter escort.

The Cheyenne — named for the American Indian warrior of the west who won the U. S. Army's respect as a tough, aggressive, and fast-moving fighting man—was rolled out at the Lockheed-California Company's Van Nuys plant in the spring of 1967 and was officially introduced in Army/Lockheed ceremonies on 3 May. Following an intensive flight test program, now underway, it is scheduled for Federal Aviation Administration certification this year (1968) and to start Army service evaluation in 1969.

Combining the best features of two aircraft worlds, the Cheyenne takes off and lands vertically like a helicopter but flies forward with the speed, ease, and maneuverability of a fixed-wing plane.

This compound combat aircraft has helicopter rotor blades, fixed wings, a tail-mounted propeller, and an advanced weapons system.

With a top speed of more than 250 miles per hour, the Cheyenne is nearly twice as swift as helicopters now in Vietnam.

A new computer system provides for weapon fire control and navigation. The digital computer "brain"

COL Kluever's article is based on his experience since February 1967 as Cheyenne Project Manager at the U. S. Army Materiel Command. He was present when the Cheyenne was first flown and has since flown the aircraft himself.

FIRST FLIGHT FOR ARMY'S NEWEST WARRIOR

The Army's AH-56A Cheyenne winged helicopter successfully made its first flight on 21 September 1967 near the Van Nuys, Calif., plant of the Lockheed-California Company where the prototype combat aircraft is under development. At the controls of the rigid-rotor Cheyenne are Lockheed engineering test pilot Don Segner and LTC Emil E. Kluever, Army AH-56A project manager as copilot

interprets all inputs from sensors, furnishing information to the Cheyenne's navigation and fire control systems.

Conceived and designed exclusively as a weapons ship, this flying arsenal packs a powerful punch. The nose turret can operate either with the 7.62 mm minigun or the 40 mm grenade launcher. The belly turret contains a 30 mm cannon. The wings will accommodate either 2.75" rockets or tube-launched, optically-tracked, wire guided (TOW) missiles—or a combination of both.

Both pilot and gunner—who are protected by armor plate—can fire any of the guns and they can fire separate weapons simultaneously. Either crew member can pilot the aircraft.

The Cheyenne will provide an ultrastable gun-firing platform, thanks to rigid-rotor system perfected under a joint U. S. Army-Navy program. In this system, the blades are fixed rigidly to the mast instead of being hinged or teetered as on most helicopters. Result is a platform that adjusts to turns and pitches and is as

Congratulations are exchanged following the first flight of the AH-56. Discussing the flight are (left to right) Lockheed engineering test pilot Don Segner (AH-56 pilot), LTC Emil Kluever (AH-56 copilot and the Army's Cheyenne project manager), and Lockheed-California vice president Jack Real (Lockheed's Cheyenne AH-56 program manager). On its first flight the AH-56 hovered, flew forward, to the side and to the rear, and made complete turns. The Cheyenne is scheduled for certification by the FAA in 1968 and for Army service evaluation early in 1969

stable to shoot from as the ground below.

"With its day and night target detection and weapons deployment capability," noted LTG Austin W. Betts, Army chief of research and development, "it will be the most versatile and potent aerial weapons system the Army has ever developed."

This agile aircraft is designed to climb 3,420 feet a minute and make a complete turn in a radius far less than that of present combat helicopters. Acceleration from zero to 230 mph (200 knots) in level flight will take you only 38 seconds. Deceleration from 230 mph to a full stop will require but 17 seconds. You can fire at a target continuously while making a decelerating turn toward the target.

Flying nap-of-the-earth, you can operate close to the ground-hugging gullies and canyons to avoid visual or radar detection. The Cheyenne will have a Doppler radar inertial navigation system coupled with a computer that will give precise pinpoint direction to tactical targets or checkpoints.

On a ferry (minus payload) mission, the Cheyenne is designed for a range of approximately 2,900 statute miles. This ferry range makes the AH-56A a worldwide self-deployable system. You could cross the United States nonstop in the Cheyenne. Taking off from California, you could fly the Cheyenne on the long hop to Hawaii and then journey across the Pacific with island refueling stops. It could also be transported aboard cargo airplanes.

You will be able to land the Cheyenne in and take off from small and unimproved areas in forward battle zones. There will be rapid turnabout capability. Within 10 minutes the Cheyenne could be serviced and rearmed for a new mission after returning from a combat flight. The Cheyenne's GE gas turbine engine could be removed and replaced in 30 minutes—a little faster than the same kind of job on your car.

No ailerons, rudder, or elevators are necessary on this aircraft. Landing gear is retractable.

The helicopter predecessors of the compound Cheyenne are the rigid-rotor XH-51A research vehicles Lockheed developed under a joint U. S. Army-Navy program. Later (1964), in an Army-sponsored modification, one of the XH-51A copters was converted into a compound aircraft with the addition of fixed wings and an auxiliary jet engine.

This compound XH-51A recently flew 302 mph, world's fastest known rotorcraft speed.

The Lockheed design for an Advanced Aerial Fire Support System (AAFSS) was selected by the U. S. Army Materiel Command following an open competition among a dozen companies. A contract for the engineering development of 10 prototypes was awarded in March 1966. Rollout of the first vehicle in early 1967 was ahead of schedule.

The Cheyenne is "the big jump" called for in 1964 by General Earle Wheeler, then Army chief of staff, who noted the need for a true weapons rotorcraft—not a conversion from other types of helicopters. The AH-56A is the first of this tough new breed.

The Cheyenne is described in an official Army report as potentially "the fastest, most accurate in navigation, most lethal, and least vulnerable of any rotary wing aircraft in the 1970-80 time frame."

It appears there's nothing "shy" in Cheyenne's future. You may be part of it.

The Showoff

Captain Edward A. Janas

DURING THE various courses of instruction at the Army Aviation School, a pilot's flying ability is honed to the peak of proficiency. Instructors at the school are constantly striving for this maximum achievement in their students, and the student is equally aware that this must be his goal. Eventually the pinnacle of success as a competent, well trained aviator is achieved, but time alone brings the experience that will make him capable of instructing others.

The new aviator is lulled into a sense of complacency, feeling quite pompous until he forces himself to the edge of sheer bravado. At this point the ill-fated "showoff" is born—truly of the "one every second" variety—the pilot who most probably will never have an opportunity to discuss his mistakes with the accident investigation board.

Of course, not all showoffs prove their shortcomings, except perhaps to themselves. Since I fall into that last category, it gives me the privilege of being around to relate my fling at P. T. Barnum's

CPT Janas was assigned to the Dept of Rotary Wing Training, Ft Rucker, Ala., when he wrote this article. He hopes this account of his actual experience may prevent others from trying to do more than can safely be accomplished.

The Showoff

maxim. The story still reminds me of the moment I abandoned my ascot and stick in favor of that very comforting hard hat and harness.

It was an extremely beautiful Sunday morning, sunny and calm, and definitely not a day to be flying a mission. But there I was on the phone at 0900 listening to the operations officer prepare me for a flight to Winston-Salem. Apparently the civilian populace wanted to view a Mohawk at the annual air show, and I was told that I would be briefed upon my arrival in Winston-Salem at 1230.

Feigning great reluctance I bade the wife farewell and postponed the glorious Sunday drive with our brood of youngsters until the next weekend. I drove to the airport in high spirits and youthful dreams thinking "I will finally show them what I can do with this super terrific flying machine," and thereby setting the stage for near disaster!

After slipping into my rather spicy orange flight suit, I proceeded to preflight. Then I steered 320° for good ole Winston-Salem, stimulated by the thought of grandiose deeds that would make me the Red Baron of North Carolina—never realizing that I would soon bear a striking resemblance to his foolish opponent.

I arrived at Winston-Salem with ample time to spare, which gave me an opportunity to park the aircraft and leisurely seek out the man who would brief me on my duties and role in the air show. This gentleman turned out to be president of the local Jaycees, and it was his task to coordinate the air show. He explained that I would have approximately 10 minutes to perform and asked what exactly could be done with my aircraft.

The throttle seemed to be at least 50 yards beyond my reach

With growing excitement, I informed him that most of the demonstrations we had performed in the past consisted of a short-field landing and a maximum performance takeoff, followed by a high speed pass over the runway. However, I hastened to add that this performance would definitely not take up 10 minutes. Nevertheless, he was delighted and said that he would expect me to perform a similar demonstration for this show.

It was about an hour until show time, so I wandered around, looking at the various aircraft on display. It was an impressive array of C-124s, C-119s, and C-123s from the Air Force; F9Fs, PV-2s from the Navy; and, of course, a multitude of civilian aircraft. To my

complete chagrin, the OV-1C was the only Army aircraft on the field—additional reason to prove the capabilities of my aircraft while bringing honor and glory to myself in the process.

During this period before the show, several Air Force and Navy pilots came to visit me and told me of the impressive stories they had heard of the Mohawk. And let's face it, I sure couldn't disappoint them after eagerly confirming all their stories, plus a few of my own.

I was later instructed to take off at 1315 and that I would be notified by radio when to begin my portion of the demonstration. At approximately 1330, after the Navy did some aileron rolls over the field, I was told to set up on a left base for runway 31 at this time, and shortly thereafter I was told I was clear to land. I turned final with a decent approach established and completed the landing just like the instructor at Rucker likes them. After completing my ground roll, I notified the tower I was ready for takeoff again and was cleared. I applied the power and the Hawk performed superbly, gear up and a noticeably steep climbout. Thus far there was no showoff technique, but things were going so smoothly that the old aviation disease — complacency — began to grip its victim.

A message from the tower informed me there would be about 10 minutes delay before I would be able to perform the high speed pass, so I turned to 270 and flew away from the stands. Another message requested that I climb to a higher altitude as I was still visible and presented a distraction to the spectators. Soooo, I began a slow climb to use up the time until I would make my final contribution to the demonstration, still on a westerly heading. During this time I had time to think and decide that the spectators really had not seen anything at all, and I would REALLY make this next run something spectacular—and I almost did just that!!

I was told that it would be approximately 3 to 5 minutes before they would like to see my final run, so I turned to the east and maintained altitude. At about 3 miles west of the airport, I was told to come in anytime that I felt ready. Now was the moment I had waited for! I stuck the nose down and removed a little, very little, power, not near as much as the unknowing —10 says to do; just enough to keep out of the red and—down we came—me and my flying machine.

We came over the runway, suffice it to say low enough and fast enough. The end of the runway was rapidly approaching, and I had decided previously I would begin the climbout over the opposite end of the runway. Now to climb her out. I pulled back on the stick with all I had in me, and sure enough my flying machine reacted accordingly.

All of a sudden things were getting a little fuzzy, and it appeared that the g meter was doing some sort of dance on the instrument panel. My right hand felt as heavy as a lead balloon, and the throttles seemed to be at least 50 yards beyond my reach. Finally, I managed to reduce power and place the machine in some semblance of level flight. I was so frightened by this time that I hated to answer the tower operator because I was afraid my voice would disclose my extreme anxiety. Eventually I managed to comply with his instructions and landed on ole 31 and was met by a vehicle that would lead me to a parking place.

The remainder of the afternoon would find the aircraft on static display, though I would have much preferred the morale boost of a double shot of bourbon.

Upon shutting down, replacing the safeties in the seat, and correcting the tremor in my knees, I was greeted pleasantly by my friends in blue—the Air Force, not the police! They offered profuse compliments concerning the demonstration and seemed quite impressed. One gentleman mentioned that he thought I had planned to do a loop at the end of my high speed pass, and this almost finished me entirely! Still struggling to maintain my composure and appear nonchalant simultaneously, this statement confirmed what I had feared, that I had almost looped at the end of the pass. With this confirmation, it seemed wise for me to quit while I was ahead of the game.

After a quiet cup of coffee in the snack bar, and time for contemplation, I resolved that in the future I would never attempt to do more than I was taught to do, come hell or high water. The lesson was learned—but it could have been an expensive lesson indeed.

Whether I was a "showoff" or just an extremely complacent pilot seems to make no difference. I don't really know which symptom was mine, but, in either case, it was almost the most spectacular show ever witnessed in Winston-Salem.

Of course I know none of you have ever done anything so reckless or foolish. However, I relate this story to affirm your convictions that there are, and were, showoffs in Army aviation—so long as there are men who dream of wearing an ascot and meeting the Red Baron!

Bird-Dogging in Vietnam

You had better know what you are talking about. The last thing the G-3 wants to hear is your stuttering and stammering

Captain Walter H. Yates

MAYBE I CAN give you some idea of what you can expect in flying an O-1 in Vietnam. Most of my experiences were confined to the I Corps area, but the mission of the O-1 throughout the country is generally the same.

When you sign in to your company, you will probably receive an extensive briefing on the general situation. This won't mean much to you at this time because of your unfamiliarity with the units, outposts, villages, and supporting fires in the area.

After you have finished all the inprocessing and briefings, you will probably get a checkout in the O-1D or O-1F. Other than being several hundred pounds over max gross, they aren't much different from the O-1A or E.

Now you are on the way to a platoon. Here you will receive a checkout on the platoon's entire area of responsibility and in particular that small piece of Vietnamese countryside that will be assigned to you. Now your platoon leader tells you that in a very short time he expects you to know every foxhole, every bend in the road, every stream, every village in your area, all unit positions and outposts, and the location of all artillery and other supporting fires.

You may think that this is a large order for such a short period of time, but believe me, you will know all this and more, because your life and the lives of many others depend on it. For example, you may be awakened one night and told to report to the G-3 of a unit working in your area. When you arrive, you find the G-3, the G-2, the G-2 air, and your platoon leader. The G-3 tells you that due to recent intelligence they plan to launch an assault on a village in your area at first light.

He wants you to take his map and draw in the exact location of each line of foxholes, each series or trenches and bunkers. He wants to know if the terrain is exactly as shown on the map. Can we land a heliborne force here? With which direction of attack would the enemy have minimum use of existing fortifications and the least cover and concealment? Where are his most likely avenues of escape?

You had better know what you are talking about. The last thing he wants to hear is your stuttering and stammering. He wants positive and concise answers.

On your first missions it would be a good idea to follow yourself closely on your map. If you develop aircraft trouble you will have little time to locate yourself. Always be ready to broadcast your EXACT position. If you do not know exactly where you are, search and rescue will have little chance of finding you.

Now that you have become fully operational, you are assigned a wide range of missions but you are prepared. On convoy covers you know the route like the back of your hand. You know every likely ambush site, you know their exact coordinates, you have contact with the artillery and are confident of the situation. When

---

CPT Yates, Dept of Tactics, Ft Rucker, Ala., based his article on personal experience encountered in reporting for his first Vietnam assignment. During his tour of duty there he flew the O-1 in the I Corps area.

vectoring an airmobile force or a medevac, you have the route planned. You will keep them away from open areas; you have a good idea of where to expect ground fire. You keep them aware of forced landing areas; advise them of the current situation and what to expect in the landing zone. You coordinate with the artillery and attack aircraft who are currently preparing the landing zone. You assure the flight leader that you will keep him informed and will do all you can for any aircraft he has down. You know your job.

Now you are covering combat operations. In one combat operation you may be called on to perform every mission that is within your capability. First you may be asked to make a visual recon of the intended operational area. Then you might be called on to direct the landing zone preparation. Or while someone else is directing landing zone prep, you might cover the convoy or vector the airmobile force bringing in the troops.

When the troops are in, the commander will want to know what you can see from your aerial platform and may ask your advice on avenues of approach, best points for river crossings, etc. He may ask you to direct artillery or naval gun fire or FAC attack aircraft on his objectives. Because of terrain difficulties, he could want you to keep him informed of his exact location. You may be his radio relay to adjacent units, higher units and to the tactical operations center (TOC). TOC may want you to keep them abreast of the situation as it develops.

As daylight fades, you could be on night ground or airborne alert to guard against enemy mortar attacks. We found that the VC would seldom conduct a mortar attack at night if an O-1 was airborne in the area. Night flying is very difficult, however, due to lack of visual references. Vietnam must be the darkest country in the world at night.

You may be lucky enough to arrive in your area during the dry season. If so, it would behoove you to become familiar with all landmarks in your area. Memorize times, distances, headings and the highest obtacle to flight you might encounter on these routes. Sooner or later you are going to get caught out by weather.

As far as altitude goes, you will have to decide for yourself at which altitudes you perform different missions best. Personally, I found that at over 1,000 feet I started losing effectiveness, so I generally stayed below 1,000. During the rainy season we were extremely lucky to have 800 feet or more.

Ground fire is another matter. Due to the type missions and altitudes flown, O-1s draw a good bit of ground fire. But after a short period of time you will learn when and where to expect it. You will find that you will draw more fire than usual just before dark because of the limited time for retaliation. On combat operations you probably won't draw any fire if you stay out in front of the advancing forces because the VC do not want to give away their position. However, when the ground unit makes contact you can expect a large volume of fire, because the VC know that you are the one who brings in the artillery and airstrikes. The Viet Cong, however, aren't quite as predictable as it might sound.

Evasive maneuvers depend for the most part on altitude, weather, terrain, and intensity and caliber of fire. Below 1,000 feet, it generally isn't a good idea to set up a climb or a climbing turn because of the resulting loss of airspeed. I personally found that descending with a full slip or a slipping turn produced good results.

Contrary to what you might now believe, the year you spend in Vietnam will probably turn out to be one of the best flying assignments you will ever have—so, you might as well relax and enjoy it.

CWO promotions pushed

STARTING 1 November 1967, the U. S. Army began reducing the length of service required for promotion from warrant officer, W1, to chief warrant officer, W2, from 18 months to 12 months.

By 1 April 1968, eligibility for temporary promotion of warrant officers from W1 to CW2 will be based on completion of 12 months of active duty service as a warrant officer.

DA Message 836377, dated 15 Oct, announced a change to AR 624-100, "Promotion of Officers on Active Duty," and outlined the progressive reduction in length of service for warrant officer promotions.

Warrant officers who complete 18 months of service during November will attain eligibility for promotion to CW2 on 1 November. Those completing 17 months of service during the month will attain eligibility on the day in November which follows their completion of 17 months in grade.

The reductions will continue in this manner monthly until April. Warrant officers who complete 13 months of service during April will become eligible for promotion on 1 April. This will complete the reduction, with warrant officers completing 12 months of service in April becoming eligible on the day following completion of 12 months in grade.

ON TOP

As a pilot I was experiencing something totally new to me. I felt something like a fish in a bucket of milk! I felt that we just had to break out on top at any second, and as I began to grow impatient I increased the throttle to full open and pulled in maximum power

Captain Vernon J. Mathern

UPON GRADUATION from ORWAC in January 1965 as a 3-3 aviator, I was assigned to the I Corps (Group) Artillery aviation section at Camp Saint Barbara, Korea. OH-23 helicopters were assigned to the section. The majority of the missions were those providing aerial transportation for commanders and staff of the headquarters and units within I Corps (Group) Artillery.

Korea is a very mountainous country laced with numerous valleys. For a new Army aviator, navigation over this terrain presents a real challenge during daylight hours, to say nothing of night flying. The country is blessed with an equally challenging climate. A constantly changing weather picture with extreme conditions of temperature, wind, and precipitation is normal.

On one spring morning of that year I had been assigned an early morning mission. I was to fly the assistant commander of the I Corps (Gp) Artillery to I Corps Headquarters at Uijongbu, approximately 25 miles southwest. One of our trusty OH-23Ds was assigned for this routine task.

Weather that morning consisted of a low overcast ceiling with approximately 2 or 3 miles visibility. After arriving at the airfield I checked the local area weather sequence reports, then stepped outside the operations building to make my own appraisal of the meteorological conditions. I could not see the tops of the surrounding hills and mountains, but I noticed an occasional break in the overcast through which I could see blue sky.

I thought, "This is just a thin cloud layer hanging over us that certainly won't get any lower, and most likely the sun will burn it off in a couple of hours." I figured the visibility was adequate since I had flown in worse conditions during a snowstorm the previous winter.

I made a decision to go ahead with the flight, thinking I would fly along the valleys below the overcast or, if possible, maybe even VFR on top. Hmmmm, the thought intrigued me.

I initialed the board certifying that I had checked the weather and NOTAMs before my first flight of the day. As I filled out my flight plan, the crewchief out on the ramp completed his daily inspection and engine runup. I handed my flight plan to the CQ and picked up my helmet and map. Then I hurried out to the aircraft and did a quick preflight, since time was now running short. I hovered out to the runway and cleared myself for takeoff, since the Korean tower operator was not yet on duty. I landed at the helipad next to the officers' club to pick up my passenger.

As Lieutenant Colonel M. fastened his safety belt he commented on the weather and asked whether the low clouds would present any problem in getting to our destination. I assured him that I was confident we could make it. We took off from the helipad, and the colonel settled back and began paging through his magazine as he usually did.

As I neared the base of the clouds I began to level off. Indicated altitude was about 600 feet. Then the thought of flying VFR on top occurred to me again. I figured it would be simpler to fly a straight line to Uijongbu on top of this layer of scud than to zigzag

CPT Mathern, presently with the Advanced Instrument Flight Division, Dept of Rotary Wing Training, Ft Rucker, Ala., wrote of his "foolhardy" abandonment of rules in hopes that other new aviators may benefit from his experience.

The overcast seemed to "pour through" a saddle like a cascading waterfall

through the valleys, and that it would be a simple matter to just pop up through the "thin" layer and be on my way.

So feeling completely confident of myself, and giving the situation no further consideration, I obeyed that impulse to climb on top. So confident was I in my own judgment about the thinness of the overcast above me that I didn't even bother to look for a hole to climb through. I simply pulled in climb power and entered the wispy stratus layer at about 700 or 800 feet indicated, feeling certain as the ground disappeared below me that I would be able to see across the top at any second.

By this time my passenger had looked up from his magazine and was gazing at the opaque whiteness all around us. As a pilot, I was experiencing something totally new to me. I felt something like a fish in a bucket of milk! I felt that we just had to break out on top any second, and as I began to grow impatient I increased the throttle to full open and pulled in maximum power.

I stopped looking at the white outside the bubble and focused attention on my flight instruments. The altimeter showed I was climbing through 1,200 feet as I eased the cyclic aft to increase my rate of climb. The airspeed indicator read 30 knots. I failed to notice that the magnetic compass indicated the helicopter was in a slow right turn. I concentrated on holding full power for maximum rate of climb and on keeping the cyclic stick centered laterally.

Lieutenant Colonel M., becoming slightly concerned, asked me if I thought we would be out of these clouds soon. Trying desperately to show no outward sign of panic, I said I thought we should be. I hoped I still had his confidence in my having everything under control.

After what seemed like 5 minutes I saw the whiteness beginning to break above us. The altimeter was climbing through 1,500 feet. In a few seconds we were in the clear air, level with the cloud tops at approximately 1,700 feet. I continued to climb to about 2,000 feet and leveled off. We looked around us and all we could see was a solid layer of white with numerous mountain peaks sticking up through it.

Somehow I didn't recognize those peaks. I thought about it

for a moment and then realized they were the peaks of mountains north of Camp St. Barbara. Since I had entered the overcast headed south, I expected to see the tops of the mountains which lie south of St. Barbara and the airfield. Then I looked at the magnetic compass for the first time and realized that I had turned approximately 180° while climbing through the "soup."

After turning and heading south again, I began to recognize the peaks of higher mountains forming the P'ochon valley and "I Corps valley." Lieutenant Colonel M., still a little concerned, asked if we would be able to get back down through the clouds all right. After what I had just experienced, I wasn't about to attempt a descent through that overcast, especially in that mountainous country.

Still trying to maintain his confidence, I told him I was sure there were clear areas further south where we would be able to descend. I explained that if we had to go as far south as Seoul to descend we could fly back up to Uijongbu below the overcast. I planned a straight line flight toward Uijongbu which would take us over a fairly high mountain range just northwest of Tongduchon and Camp Casey.

As we approached this ridgeline we were able to see around the far side of it. To our delight we spotted a small bowl-shaped valley which was cloud free nestled in these mountains. Yet on the opposite sides of the mountains surrounding this small round valley was a heavy overcast. I made a slight left turn and began descending toward the clear, green valley floor, which had an elevation near 1,000 feet.

On the southwest side of this small valley was a saddle through which the overcast layer on the outside appeared to "pour through" like a cascading waterfall. I headed toward another saddle on the southeast side of the valley. Here the overcast layer didn't appear to "pour in," but had a definite base below which I could see about 200 feet of clearance from the ground. I made straight for that opening and slipped through it beneath the overcast. Now I was heading generally southeast as I zigzagged around numerous smaller hills and through fog shrouded gorges.

At last I reached the floor of the large valley just north of the town of P'ochon. I was now in very familiar territory and much more at ease as I pressed on, following the highway southward past P'ochon. I was able to maintain an average altitude of about 300 feet above ground and still remain clear of the low ceiling. Visibility averaged about 2 miles. I continued toward Uijongbu flying "IFR" (I Follow Roads).

To my surprise I met another OH-23 flying by the same rules headed in the opposite direction. As we saw each other we acknowledged visual contact in the usual manner by keying the mike twice "beep beep." Approximately 3 minutes later Uijongbu came into view. I transmitted on FM, "Bullseye Tower, Raven 152, 2 miles east for landing at H-209." We proceeded in to the I Corps (Group) helipad and landed without further incident.

My passenger got out and walked to the headquarters buildings for his conference. I shut down the helicopter to await his return and subsequent flight back to Camp St. Barbara. As the rotor coasted to a stop I remained sitting in the left seat and sighed with tremendous relief. I began to recall the flight I had just completed, and now for the first time a nervous feeling began creeping into my whole body.

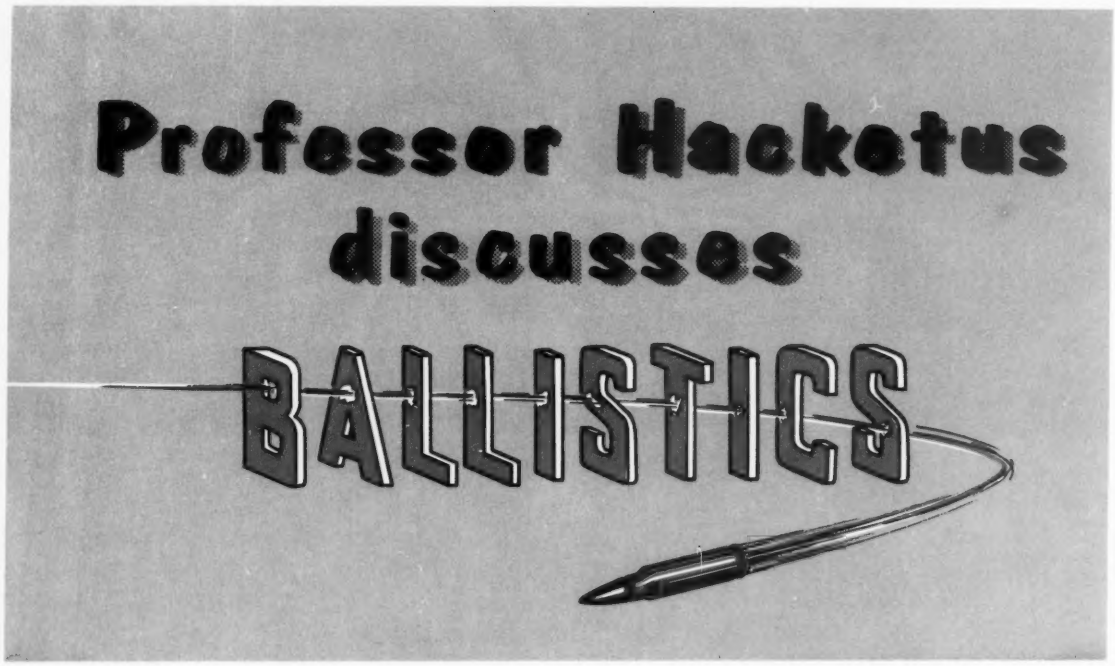
I thought about the climb up through the overcast again and again, each time with more recollection of detail. I began asking myself why had I done that thing. What provoked me to take such a risk—to risk the life of my passenger, a high ranking and very important person? As all these thoughts kept going through my mind I became overwhelmed with a feeling of fright and guilt. I trembled so inside I began to feel slight nausea. I vowed to myself I would never, ever attempt such a foolish thing again and thanked God we came through it alive.

As I waited for Lieutenant Colonel M., the heat of the sun dissipated the cloud layer. The flight home was not hampered by weather, but I felt like a grateful criminal on parole. My every move was extra cautious, using "by the book" procedures as best I could. It was months before I breathed a word about my experience and only then to one close friend, but I felt I had learned a real lesson.

My instrument training in flight school amounted to 3 hours, 15 minutes of hood time in a UH-1, and 9 hours, 45 minutes of synthetic trainer time. I had received no additional instrument training before this hair raising experience.

I've written this story of my personal experience with hope that it may help someone in a similar circumstance to consider the situation thoroughly, and the possible consequences of such action. A newly graduated Army aviator has a license to learn from flying experience in the field. It is expected that he will explore his capabilities and do some experimenting on his own. However, exploring beyond one's knowledge and capabilities often leads to disaster. An aviator who is exploring and experimenting with passengers aboard is guilty of neglecting large responsibilities as well as using very poor judgment.

Professor Hacketus discusses BALLISTICS



Lieutenant Michel D. Caldwell

WITH A FEELING of suppressed inadequacy mixed with confusion, I left the colonel's office on my new assignment. Although I had on occasion fired a few rounds from the door of a helicopter, I certainly was no expert on door gunnery. Nevertheless, I now had the task of writing and teaching a theoretical course in door gunnery. Fortunately the colonel gave me a lead. He suggested I contact Professor Josiah Hacketus, a ballistics expert who had recently retired.

Professor Hacketus proved to be a good natured man in his late sixties with snowwhite hair that complemented the crimson sport shirt he was wearing. When I told him my problem he motioned for me to come in, telling me to take the pressure off my feet. Then going to an antique Elizabethan cabinet he brought out a bottle and two glasses.

"It seems a man my age needs an excuse to drink or people think he's getting childish," he said with a mischievous smile on his face. "Hmm, so you have to give a class to doorgunners on the principles of air to ground machinegun fire.

"You must first of all realize that you are very fortunate to have such a fine weapon as the M-60 machinegun. I have heard that it requires relatively little maintenance. Its relatively flat trajectory means that few ballistic problems arise, other than those encountered by a few doorgunners who tried to ignore the skids or the stabilizer elevators of their aircraft when engaging their targets."

Professor Hacketus then rambled on about how the relatively dense metal in the skid disrupted the aerodynamic flight characteristics of the bullet, making its trajectory very hard to predict and therefore unreliable.

When I pressed him to give me an example of a bad weapon he replied, "The M-79 grenade launcher or the M-5 kit."

"I thought that the pilots who used those weapons swore by them!" I exclaimed in surprise.

"They may and probably do, but the low muzzle velocity of the

---

LT Caldwell, now a civilian attending the University of California, Los Angeles, was with the Dept of Tactics, Ft Rucker, Ala., when he wrote his article. Though fiction, his narrative is based on training and personal experience.

He cited the M-5 as a "bad" weapon

40 mm projectile means that the various factors that physicists theorize about actually begin to be noticeable, and therefore the gunner may well have to do some thinking before he shoots."

"What are these problems?"

Well, the most important problem is one which we call target lead effect. It was discovered one evening as we were navigating back from a convention where we had consumed a large quantity of brew. We still had a few bottles remaining, which were being drained of their contents as we drove along. Soon we saw a stop sign up ahead and Joseph Schmidt, who tended toward applied rather than theoretical physics, let loose with an empty bottle at the stop sign."

"Did he hit it?"

"No, unfortunately he missed by a good 75 feet, and almost knocked off a motorcycle policeman in the process."

"I bet that caused a row."

"Quite so! After we had settled down together in the cell another member of our party accused Joe of failing to consider all initial conditions. The result of the argument was that Joe admitted he forgot to lead the target and promised that as soon as he got out and sobered up he would feed the problem into a computer and next time would hit that patrolman dead center."

I asked the professor to explain what this lead effect was. He said that when a bullet was fired from a moving vehicle, we could think of it having two speeds and two directions at the same time. The first velocity was what he called the muzzle velocity of the gun.

"The M-60," he said, "and all other weapons that use the 7.62 NATO round have a relatively high muzzle velocity of about 2,800 feet per second. Because this muzzle velocity is so high, the other factors such as gravity and aerodynamic jump don't have enough time to take effect.

"The other velocity that the bullet has is the aircraft's velocity. When the bullet is fired, the helicopter, gun, *and* bullet, are also flying along at a speed of about 80 knots which, to use the same terms as we used with muzzle velocity, is about 135 feet per second. We can quickly see that even with the helicopter going at nearly maximum speed the effect of the aircraft speed will be only about 1/20th that of the bullet's velocity. However, with the M-5 system we have a different story. There the muzzle velocity is only 790 feet per second. As you can easily predict, the lead effect there becomes far more troublesome."

"Just how does this affect the bullet?"

"Well, it all depends upon where you aim. If you aim straight ahead in the direction you are flying, the only effect it will have is to make the bullet go faster. This means that the bullet will get to the target faster and will not have time to fall very far."

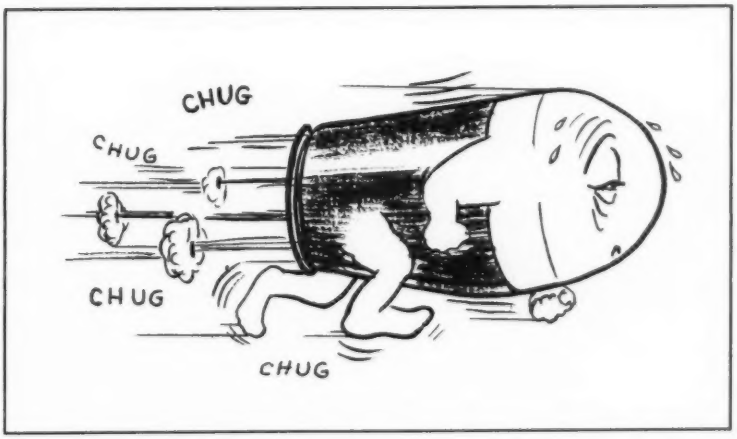
"Fall?"

"Yes, in accordance with the law of gravity, the instant the bullet leaves the gun barrel it starts to fall. However, the standard NATO round moves out so fast that we find that it will travel approximately 600 meters before it falls the height of a man.

"Now I have been told that in Vietnam the pilots rarely bother with targets more than 400 or 500 meters away, and so for the M-60 we can forget gravity. Notice, though, that with the M-5, again the projectile is moving so slowly that gravity has time to significantly affect it and therefore must be taken under consideration.

"Anyway, to get back to lead effect, when we aim straight ahead, all we do is increase the effective muzzle velocity of the gun, which for the M-60 means that the bullet won't fall as far, and we will hit Charlie at the second buttonhole instead of the third—that is if Charlie is wearing a shirt. The headaches begin when we aim our guns in a direction different from our heading.

"Let's say that we aim our guns out to the left side of the helicopter. Now when we pull the trigger our bullet moves out toward the target *and* also forward along with the aircraft, just as Joe's beer bottle did. Unless we compensate for this tendency of



Professor Hacketus's Ballistics

the bullet to continue its forward flight, we will find that we stand a good chance of missing the target altogether."

"How do we compensate for this effect?"

"Well on this point the experts run into semantic problems. Some say we should 'lead' the target while others prefer to 'lag' it. There was a bitter fight until it was discovered that everyone meant the same thing—namely to aim in the direction the target *appears* to be moving.

"The amount of lead we give the target depends upon three things: the aircraft's speed, the muzzle velocity of our weapon, and the angle off the nose. I think the first two variables and their effects are obvious. The third variable also becomes clear when we stop to consider that we have no problem when we are firing straight ahead or to the rear, but run into quite an effect when shooting at angles approaching 90° off our direction of flight."

"Wouldn't range to the target be a factor?"

"Yes and no. If you talk about lead in terms of angles you don't have to worry about the distance to the target. However, if you like to think of leading a target by so many meters or yards, then you will have to take the tangent of the lead angle and multiply by the range to get the lead distance."

"How big is this effect?"

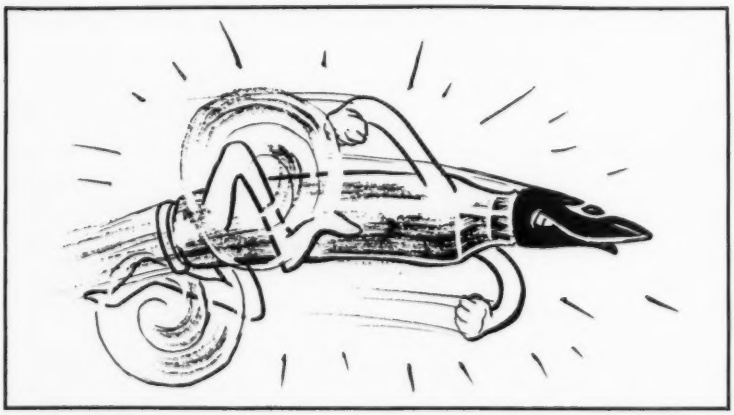
"Well, let's take a helicopter cruising at 80 knots. If a doorgunner were to fire an M-60 straight out the door or in a 90° direction he would be about 2½° off."

"That's not very much."

"Well, maybe not, but it's enough to miss by 4 to 5 feet at a target 35 meters away."

"I see what you mean. Are there any other factors we need to worry about?"

"Well, that depends upon what weapon you are talking about. For the M-60 machinegun or other weapons that fire a high speed NATO round no other effect, except perhaps for gravity at ranges over 600 meters, need be worried about. With a slower projectile other problems of drift and jump come into play. Briefly, these are caused by the fact that the projectile is not aimed straight into the relative wind but is to a certain extent 'crabbed' (or in a yaw of repose). The air moving by, or what we call the relative wind, then tends to exert a force on the projectile causing it to drift, usually to the right. It becomes particularly confusing when we have to consider the fact that the spinning bullet acts like a gyroscope, and thus forces acting on the bullet will have their effects shifted 90° clockwise as viewed from the gun."



"Hold it!" I exclaimed. "I think I've had just about all the theory I can take for now. I wonder how anybody could ever understand all these effects."

"Well, it's not *that* difficult," my friend replied. "It just sounds that way. In fact with the M-60 machinegun they have found that pilots and doorgunners can develop a fair amount of skill after just a week of practice with tracers."

"I forgot about tracers. They must make the job of hitting a target quite a bit easier."

"Yes, they do. However, they also present certain problems."

"Oh?"

"Yes, we have found that with ranges of 600 meters or more we get into a changing frame of reference problem which I call 'observer shift.' It arises when a doorgunner fires out the door at angles approaching 90°. By the time the bullet gets to the target, which is on the order of a second or two at these long ranges, the helicopter has flown forward about 150 feet.

"Let us say for the moment he aims just a little too high. By the time the tracer strikes the ground he has moved forward enough to see the strike of the bullet from a different angle. Thus a doorgunner on the left side would see his bullet strike the ground high and to the right, when in reality his only error was to aim a little high. This effect becomes even more deceptive when our friend is shooting at targets which are beyond tracer burnout range."

"What can we do to correct this?"

"Well, with a little practice a doorgunner can learn to compensate for this effect, particularly if he has been made aware of its existence in the classroom. Secondly, if the gunner has some form of usable sight he might do better to rely on his sight and ignore the tracers at great ranges. Finally, we can be thankful that in Vietnam, at least, we don't have to worry too much about this problem since most of our targets are well within 700 meters. In any case, the effect would only amount to about 2 to 5 feet with the M-60."

"What about the M-5?"*

A loud groan told me that there we had a problem. He pointed out that again we had a case where the helicopter was traveling at speeds approaching that of the projectile. He said that if we were to draw the triangle formed by the trajectory of the round over the target, the helicopter flight path, and the line of sight from the gunner to the place to where the round impacts, we would see that there the effect is quite noticeable.

I thanked Professor Hacketus and departed hopefully a little wiser in the ways of air to ground ballistics.

*An automatic lead angle compensator is under procurement for the M-5 40 mm subsystem and this item will become available for installation, in the field, this month. The design of all follow-on 40 mm aircraft subsystems includes automatic lead angle compensation.

GULP!

A weird mechanical monster swallowing a human being? Not really. A helicopter mechanic in "over his head" adjusts the synchronized elevator of an Army UH-1B Huey. We are indebted to SP5 Sal J. Crisanti for this unusual photo. Send in your safety captions. The DIGEST will publish the best in a future issue.

One For The Money

Major John K. Ham

TO SAY THAT procedures for the safe operation of twin engine aircraft are somewhat different from the procedures for operation of single engine aircraft would not strike many people as a very profound statement.

Yet, during operational missions I have observed pilots in twin engine aircraft resorting unnecessarily to techniques and flight profiles that had little or no relationship to safe multiengine procedures. These techniques would possibly have been considered quite reasonable for a single engine bird, but just didn't make good sense for safe twin engine operation.

Let's establish a common ground on which to build further agreements in this business of safe twin engine procedures.

Although there may be several good aerodynamic reasons for hanging two fans on an airframe rather than one, it is my contention that the main selling point is safer conduct of flight. This would not necessarily be so, except that the FAA requires that a twin engine aircraft licensed for commercial passenger use be capable of operating on only one engine (maintain altitude, climb, etc.) under certain conditions before the particular bird can be given a certificate of airworthiness.

So it would seem to follow that if you put yourself unnecessarily in a flight profile whereby if one engine failed the remaining engine could not keep you from buying the farm, you have, in fact, not used that extra engine for its primary intended purpose.

Procedures, general knowledge, and techniques in the operation of twin engine aircraft are more varied among aviators than most of us would begin to believe. That is not to say that they are all incorrect, just different. Also, in some cases pilots who have, for

MAJ Ham was an instructor pilot in the U-8 Branch, Flight Training Division, Dept of Advanced Fixed Wing Training, Ft Rucker, Ala., at the time he wrote his article. He since has retired and is now living in Texas.

a twin engine review

example, been using good, sound takeoff procedures do not really understand why they leave the ground in a particular attitude and resultant airspeed. They only do it because "that's the way they were taught." It is not my purpose or intent to educate the inexperienced or insult the oldtimer with these writings, but instead to give food for thought in the form of a review and discussion (one-sided though it may be) of sound and safe twin-engine procedures.

I will attempt to make my remarks general enough to apply in theory to all light twins, but specific as far as the U-8 is concerned because of its prominence in the present inventory.

TAKEOFF AND VMC

The normal takeoff in a single engine airplane is not a very thought provoking maneuver to pilots with three or more hours in the particular craft, but in twin engine aircraft if it does not provoke thought in depth with each takeoff run, the flight could end in disaster. I believe it is safe to say that the takeoff and initial climbout is the most vulnerable portion of the average flight envelope of multiengine aircraft. No discussion of this maneuver would be complete without a thorough understanding of the most misunderstood term in aeronautical language, VMC (Velocity, Minimum Control) or (Very Much Confusion).

Basically, VMC is the minimum speed at which, with takeoff power on one engine and the critical engine inoperative (no. 1 in U. S.), you can stop the yaw of the aircraft with full rudder. Now this speed will of course vary if the inoperative engine prop is feathered or windmilling. A windmilling prop induces drag, thus computed VMC speed must be higher. As an example the U-8 VMC is 85 knots windmilling and 80 knots feathered.

Now here is where the confusion appears to creep in. Question: If you have VMC, and the critical fan gives up the ghost,

can you fly away straight ahead after you stop the yaw? Answer: Your guess is as good as mine. It depends on too many variables for a pat answer. I don't mean to be glib so let me explain further.

When the FAA talks about VMC they say you should be able to do two things at that particular speed. First, stop the turn which results when the critical engine is chopped and do so within 20° of turn; and, second, you must be able to fly away on the new heading.

Of course when they go through this drill in certifying a new bird they place certain other requirements on the manufacturer such as:

- Maximum available power on good engine
- Rearmost c.g.
- Flaps in takeoff position
- Landing gear retracted (extended for U-8)
- Maximum sea level weight
- Prop on critical engine windmilling
- Standard day temp (59° F)

Now the confusion is in the statement of the second requirement "must be able to fly away on the new heading." Full belief in that avenue of escape if one engine quits at VMC and low altitude is a potential one way ticket to Arlington National Cemetery.

It just can't be done at max gross in most aircraft. Pick up any —10 and read for yourself. If you don't have safe single engine speed, forget it. You're going in if no. 1 quits at VMC as established by FAA if you don't gain airspeed and clean up. But even if it were possible to maintain altitude at VMC, anything higher than a grain of sand at your altitude would be real trouble because you certainly cannot climb.

Now if you are 400 pounds under gross, or at gross and the density altitude is —1,500 feet, you might have a chance.

But the point is, it's a critical area and should be passed through to safe single engine speed as soon as possible. (Definition: SSES—that speed which will allow the aircraft to climb a minimum of 100 fpm at max gross, prop feathered, gear and flaps up, and takeoff power on operating engine.) And if an engine quits before you attain safe single engine speed (normally 10+ knots above VMC) be fully aware of your situation so you can make an intelligent decision.

Possibly the best procedure if one quits just after liftoff and below safe single engine speed might be to reduce power on the good engine and control crash straight ahead. Although this may be a tough decision to accept, it is far better than crashing in a wing low attitude out of an uncontrolled turn.

As far as you and I are concerned as pilots, VMC has one important meaning. If we allow the airspeed to get below VMC we cannot control the yaw of takeoff power on one engine if the other fails. If we try it we will most likely have the opportunity to practice spins at low altitude.

The average pilot cannot control the aircraft when no. 1 engine is suddenly made inoperative at VMC. The idea that it can be accomplished is some pencil mechanic's calculation of perfection. Reaction time, signal to the muscles, movement of the controls, etc., will require some undetermined time.

Somewhere at or above VMC we will be able to "fly away straight ahead." But this will depend on weight, density altitude, and of course drag, such as gear and windmilling prop.

It stands to reason that if you are at 85 knots in a U-8 (VMC) and only 30 feet in the air with gear down when an engine quits, (assuming you do not elect to control crash) you must do the two things FAA talks about. First, stop yaw. That is accomplished with rudder (usually all of it at takeoff power). Second, fly away on the new heading. To do that you must first feather the engine because the bird will not, repeat not, carry a windmilling prop at VMC. Then you must gain airspeed to safe single engine speed so that you may climb. To gain airspeed you can trade altitude for it — which at 30 feet you don't have to trade. Or have available to you about 7 to 12 miles of open ground or water in which to clean up (gear and flaps up) and slowly accelerate to SSES. As you can see, it's an almost impossible situation, certainly one which you could not hope for at most airfields. Therefore, if we can develop a technique whereby we are above VMC on initial liftoff, and at such an attitude to gain airspeed rapidly with a reasonable gain in altitude to clear the airfield obstacles, we have done about all we can in planning a safe takeoff.

In the U-8 we teach students to rotate the aircraft at 70 knots — not start rotation at 70, but be at rotation (nose gear 3 to 6 inches off the runway) at 70 knots. Students can start this rotation at any airspeed they like but 60 knots seems to work out best.

This rotation is the takeoff attitude. If held in this pitch position, the aircraft will break ground between 85 and 89 knots with 0 flaps.

After liftoff the aircraft will gain airspeed to 95 knots (safe

single engine speed) in a matter of 2-4 seconds provided the rotation pitch attitude is held.

At safe single engine speed or usable runway gone (whichever occurs first), the gear is no longer useful and should be retracted.

This same general pitch attitude can be held until the climb airspeed is reached and power is reduced to normal climb power.

Experience shows that right here is the most likely place for engine problems (the reduction of power from takeoff to climb setting). Therefore, this reduction should be delayed until clear of all field obstacles. Then reduce to normal rated power at 3200 rpm. Further reduction in power if required by unit policy should not be made until safe altitude is gained to enable a return to the departure airfield without further gain in altitude in case of engine failure.

Trimming for takeoff is of course an individual pilot technique area, but one system that many of us use is to set the aircraft up with normal climb power and speed trimmed for hands off flight. Then monitor the elevator trim and use that setting for your subsequent normal takeoffs. This eliminates the future trimming process during most subsequent climbouts.

Although the aforementioned airspeeds apply to the U-8 in particular, they can also be used in the T-42. Regardless of what light twin you operate, the same theory should apply.

Now some will argue that an even better procedure for takeoff would be to leave the aircraft on the ground until 95 to 100 knots, then lift off, level out and accelerate to climb speed and then gain altitude.

I don't agree!

If you are going to admit the possibility of an engine failure somewhere in this procedure, it doesn't make much sense. Remember that the drag increases as the square of the speed, and the faster you are going, the greater the drag of the dead prop. At 107 knots the drag is one and one-half times that at 87 knots. At 122 knots drag has doubled, and at 174 knots drag is four times that at 87 knots.

The pilot using this fast takeoff procedure can suddenly discover that he has converted all the energy produced by those two engines into speed, and that upon engine failure the speed deserts him immediately. Of course there is the argument that you can use this speed to "zoom up," but you will find that an unexpected engine failure leaves the average pilot feeling like he is swimming around in glue for a few seconds. By the time he has control of the situation and is ready to use the speed, he finds himself down to about the speed he should have been at all the time — but still at 30 feet! From this point he will have to climb — with an engine out — to whatever height is needed to clear the obstructions at the particular field and get back to the end of the runway.

The other end of the spectrum would be a max performance type liftoff, nose high with early climb at low airspeed. But remember VMC. Max performance takeoffs are normally done below or near VMC until over the obstacles. Although they may be desirable under certain field conditions, the below VMC liftoff is a potentially dangerous situation and could never be acceptable as a normal technique.

My recommended takeoff procedure leaves you vulnerable (below SSES) for only 2 to 4 seconds. And under normal temperature and runway conditions I have useable runway left to cover those 2 to 4 seconds. In reality I'm home safe throughout the entire takeoff and climbout at most airports, and I can accept the 2 to 4 second hazard area at the rest.

CLIMBOUT

About the only thing to be said here is, use good training habits and you can't go too far afield.

If an engine quits during a climb the aircraft should immediately be put in a level flight attitude. Some will say that the nose can be held in a climb attitude and dead engine cleaned up while you are continuing to climb. True, true, true — if you're real sharp and practice this sort of thing each day as in a training activity. But what about the engine that quits on you, not because some IP pulled the mixture but because no. 1 swallowed a valve?

Remember the "swimming around in glue" situation? Well, it happens. Just ask any pilot who's experienced actual engine failure. Training takes over dur-

ing this brief but important period. Assuming you are above all airfield obstructions, it's nice to have that precious airspeed stay at normal climb speed while you are level and taking care of feathering the dead engine prop — rather than dying off to below SSES because you held the nose up while you were cleaning up.

It is safe to say that as long as you are reasonably above all obstructions, it is never necessary to climb any further in the traffic pattern when an engine fails. But if you want another few hundred feet for comfort's sake, gain it after you have the dead prop feathered and normal rated power (METO) established on the good engine.

You will find this makes for a much more comfortable recovery, with airspeed remaining well above SSES.

STRAIGHT AND LEVEL

We should be so lucky to have them quit straight and level at altitude. But if it does, remember these important points:

If you are not absolutely certain of the cause of stoppage, such as fuel starvation, I would think several times before attempting a restart. You just might catch on fire.

Second, use the lowest practicable power setting to get the job accomplished of taking you to the nearest available landing surface.

TRAFFIC PATTERN

What is too close, and is 3 miles too far for the downwind leg? Well, too close might be when you are so close that the landing surface is hidden from your view by the engine nacelle. Too far could be when you could not make the landing surface with both props feathered.

Some eyebrows just raised, I'm sure.

But before you condemn this idea, go out with your unit IP and put both props in a zero thrust condition on a downwind 180° side approach position, ½ mile out from the runway. From that point you can make an immediate turn to base and final and make the landing surface with relative ease.

If this same general pattern is flown with power for a planned ½ mile final, you will discover that by placing zero thrust on both props and an immediate turn to the landing surface you can make it from any point on base leg with ease. Granted, the odds against both fans quitting at the same time are astronomical, but this procedure does give you a good yardstick for reasonable light twin traffic patterns.

GEAR DOWN

When is the best time to extend the landing gear during a single engine approach? This is an area of great variety in opinions.

Here's my theory.

Assume engine failure occurred somewhere before the normal gear-down position of the traffic pattern. Now, to start the descent for landing (either on base or straight in final) and to keep from gaining excessive airspeed, an initial power reduction is made. Establish this reduced "power on glide" so that if nothing were changed you would crash in the middle third of the runway. Then instead of reducing power further, put the gear down and allow its drag to increase your angle of descent, thus bringing you closer to the intended point of landing. After that, flaps and further power reductions can be used to pinpoint the landing.

Some pilots advocate leaving the gear up until short final. That's all right I guess, but what if it doesn't extend as advertised? Result: either belly in or make a hazardous low altitude, low airspeed single engine go-around. Not me. If my gear won't extend, I want to know it at 900 feet or so in the air with good airspeed for the level off and emergency gear extension procedures.

GEAR AND FLAPS

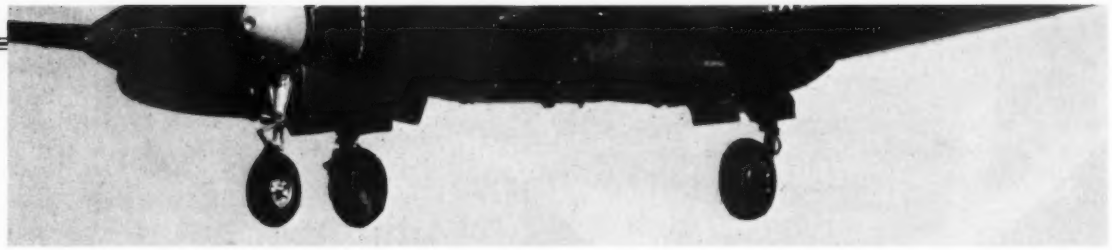
I have not flown all twin-engine aircraft in the world so I cannot vouch for all twins. But I can say that of those presently in the U. S. Army inventory, once gear and flaps are extended at the 180° side position and an engine fails (assuming the aircraft is in a normal approach and not 7 miles final) there is no, repeat no, purpose of putting them up to continue the approach. It's far more rewarding to spend your time controlling the aircraft's direction and velocity rather than fumbling with gear handles that might not come back down again and losing lift by raising flaps. Just feather, adjust power as desired, and spend the rest of your time in good aircraft control.

FINAL APPROACH

Final approach engine-out procedures are duck soup if your normal approach is reasonable and final landing check is made as early as possible after turning final.

The governing factor for a safe final approach to a normal landing is power available if one engine quits.

Most experienced multiengine instructors recommend only 25 percent, and certainly no more than 40 percent of available power be used on final. The rea-



son is quite sound. If you are using 51 percent power on a long flat final and one engine fails you don't have enough power left to make the landing surface. That is simply because one engine must now produce double effort, or 102 percent of power available — you will agree it's not mechanically possible.

By performing the final check early on final approach, you place the prop levers to full increase and recheck gear down and locked. Then if an engine quits, all you have to do is add power with both throttle levers. There is no need to identify or feather, thus turning a critical area into a piece of cake.

COORDINATION

One last point. I have observed many pilots trimming an engine-out bird by using aileron in addition to rudder trim.

Engine-out yaw is controlled by rudder alone — not aileron. If you want to trim the dead engine up 5°, fine, but don't use more aileron than necessary for that task.

The next time you are out practicing single engine work, put your feet on the floor and chop an engine. Now keep the aircraft straight and level with aileron and elevator controls alone. You will immediately notice that you are in asymmetrical flight. Now do the same thing with rudder and elevator only and you will prove to yourself that aileron hurts, not helps, you in straight and level flight on one engine.

Granted, I have not covered all eventualities in twin-engine emergency procedures, but I do believe those discussed are the most controversial. In most likelihood they still are, now that you have read my ideas on the subject.

Cayuses Is Coming

Mass production of Army's OH-6A "Cayuse" light observation helicopter is well underway at Hughes Tool Company, Calif., assembly plant (right). The turbine-powered craft, can carry 5 fully equipped troops plus the pilot. Two OH-6As, of the initial procurement of 1,071, are now in Vietnam for equipment training purposes.

THE NEW LOH

an ideal military police vehicle

Lieutenant Colonel Frank E. Hearn, Jr.

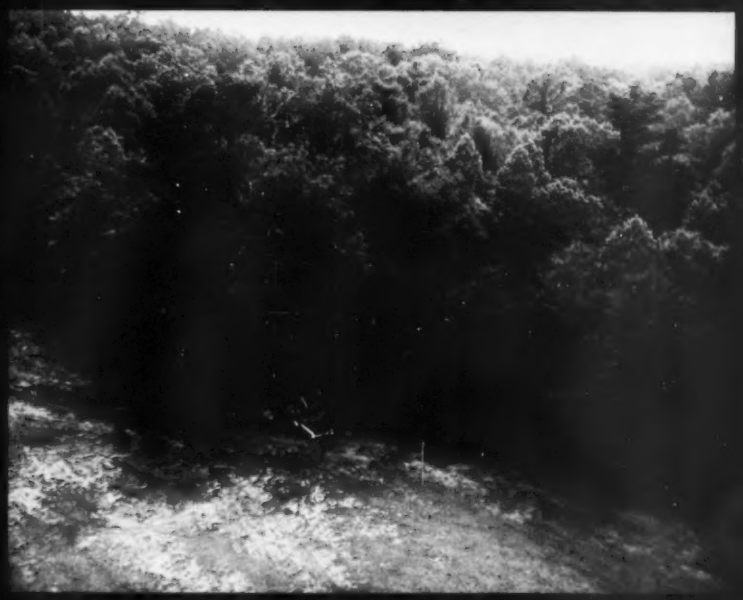
SINCE WORLD WAR II, the Army has gradually modernized with new weapons, tactics, and equipment. As part of this modernization program, most branches of the service have received aircraft to fill important battlefield missions.

The Military Police Corps has also modernized itself with new equipment and better ways of doing things. However, aircraft are not always available to the military police (MP) in performing duties, especially in the continental United States. But the MP have studied the best ways of using helicopters and are teaching these methods in the Military Police School at Fort Gordon, Ga. In Vietnam and Europe where some aircraft have been made available, the MP have used them very effectively.

On the ground, the military police are usually given light, fast moving vehicles that allow them to move quickly from area to area, faster than the heavy trucks and other vehicles generally found in military units. In the air the military police will also need fast aircraft. For this job the new light observation helicopter with a cruising speed of 128 knots and a range in excess of 300 nautical miles is the best helicopter now in the Army inventory.

Although the LOH will carry only five troopers and the pilot, it can perform many functions

COL Hearn is Provost Marshal at Fort Rucker, Ala. He is a graduate of the Company and Advanced Officers Courses at the Military Police School, Fort Gordon, Ga. He also taught at the MP School from 1954 to 1956.



The LOH is able to get into and out of confined areas much better than larger aircraft. In the case of automobile accidents the MPs can quickly locate and get to areas even though they may be isolated from the main road. In the case shown above and below, MPs were on the scene within moments after the accident occurred, but the victim had been killed instantly. At left the MPs locate and rescue a lost boy

From the air, military police could provide valuable assistance to the ground forces

for the military police. For instance, it would make an ideal air patrol vehicle.

Air patrol consists of using an aircraft to perform essentially the same function as a ground patrol. By using the LOH military police could cover more routes and a greater area. Also the aircraft could survive in nonsecure areas for longer periods than could ground vehicles.

Air patrols would only be assigned to areas where patrolling could best be performed by helicopters. For example, air patrols could cover pipelines, inland waterways, railways, alternate supply routes, bypass routes, and other routes that cannot be effectively patrolled by ground vehicles.

Route and area reconnaissance is another military police function that is a natural for helicopters like the LOH. This type reconnaissance requires mile-by-mile, nap-of-the-earth flying, hovering, and periodic landing to fully evaluate route and area conditions. The LOH with an endurance of 3 hours at 100 knots and a rate of climb of 2,000 feet per minute could cover a wide area and get away quicker when attacked by a hostile force. The overall length of the LOH with the rotor turning is only 30.31 feet. Thus the LOH could get in and out of confined areas better than could larger helicopters.

The primary reason for route and area reconnaissance is to maintain up-to-date information on alternate and bypass routes and of areas not being used by friendly forces. Inhabited areas and main supply routes, in most instances, can be covered by ground patrols while less inhabited areas and less used routes could best be patrolled by helicopters.

The problem of column control would be greatly reduced with the use of fast, light helicopters. From the air military police could provide guidance and assistance to commanders of troops or convoys in march formation. Aircraft would be used primarily for visual observation and secondarily as a radio relay. The airborne military policeman could help the commander select suitable bypasses around damaged bridges, possible ambush areas, or other road obstacles with the least possible delay. Lost elements could be quickly located and directed back to the march route.

Armed LOH could even provide movement security. In the event of ambush or attack, they could provide limited aerial firepower to help extract the attacked unit.

Certain prisoners of war have special intelligence value and by necessity must be moved quickly from the forward area to the rear for detailed interrogation. The LOH would be ideal for this, as it is small enough to isolate the prisoner and yet large enough to allow for guards.

The military police could also use the LOH in damage control, refugee control, straggler control, riot control, river crossing operations, beachhead operations, criminal and accident investigation, and critical personnel movement.

Use of helicopters by military police has been of tremendous value in conducting security surveys of installation perimeters and other areas not easily accessible by ground vehicles. On those installations where the military police are employed in conjunction with the Department of Interior, Fish and Wildlife Service, helicopters are used for study of movement and control of game, as well as for observing the activities of hunters and spotting poachers. As in any modern police force, the use of helicopters by military police traffic personnel greatly assists in evaluating traffic flow problems by observing widely spread congested areas from the air by one military policeman, thus fulfilling the mission and conserving manpower.

In such emergencies as disaster, civil disturbances, relief and search and rescue operations, the military police play an important part. The use of helicopters in such emergencies would improve the effectiveness of the military police in such cases and would not only improve public relations but could conceivably be an important factor in saving human lives.

These are the main missions of the military police in which the LOH could be used to advantage. Under present conditions the military police are hard put to perform all their missions with only ground vehicles at their disposal. Helicopters would provide them with the added flexibility, mobility, and responsiveness they need.

In the days when the use of armed helicopters was restricted, this attack by a Vietnamese battalion supported by a platoon of Hueys carried the real element of

Surprise!

Lieutenant Colonel Richard E. Mack

"SIR, I GOT THREE of them," the door gunner shouted as he looked back down at the bald hilltop which the Huey had just skimmed over.

There on the ground lay three Viet Cong and not far away four more were scampering for the surrounding jungle. The Specialist 4 inserted another magazine into his M-16. The pilot, looking over his shoulder, banked for another run on the target.

"We sure surprised the Charlies in this area," the pilot said as he aligned his craft. "They have been so used to taking pot shots at us while we were escorting the Marine choppers, that they don't know what to do when we go after them on purpose."

He caught the VC with the whole choleric blast of his armament as they made a frenetic attempt to return to the concealment of the jungle.

The pilot was not being peevish, since the rules of engagement for all practical purposes protected the VC by giving them the element of surprise. What was a pilot to do when fired upon, except to blanket the area with fire and fly away leaving the vindictive Viet Cong with a moral victory?

It was unheard of to purposely plan for the use of this weapon to support a battalion in a search and destroy operation, and thus play the VC game of "surprise." All the same, there were a few incidents where individuals stuck their unconventional necks out and said, "Tallyho, after the VC we go!"

This is one of those incidents, and it all started with a scrambled telephone conversation that went something like this:

"You know the rules of engagement as well as I do, my friend. You can't use armed Hueys for fire support."

"What do you mean they can't be used? Do you recall what that visiting general said a few weeks ago, when you quoted the rules of engagement to him? As I recall he said:

> 'Any rule that prevents the use of a weapon needs to be continuously modified in any war and especially in one that is as mercurial as this war. It is insane to arbitrarily limit your combat power by following a self-imposed restriction on the use of armed helicopters. Their mobility provides us with the element of surprise with an enemy who has a considerable capability to dissemble and hinder other forms of responsiveness. Don't tell me the rules; I know them. Tell me when we should change the rules in order to get the edge on the antediluvian enemy and his type of warfare.' "

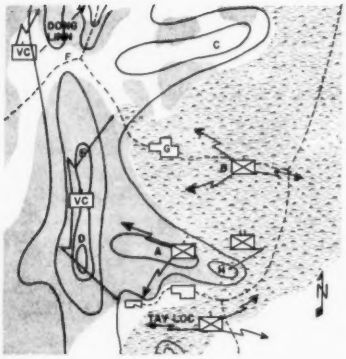
The advisor folded up the paper on which he had written his interpretation of the general's remarks and listened in silence for the response at the other end of the line.

"You were the guy who briefed our visitor on the use of the Hueys at Hiep Duc and Phuoc Son, weren't you?"

"Affirmative."

"I'll tell you what I'll do. When

Though not an aviator COL Mack praises Army aviation, based on an experience in Vietnam. He is assigned to the office of the Deputy Chief of Staff for Intelligence, U.S. Army, Europe.



Sketch 1

the old man comes in I'll talk modifying the rules to him and we'll both put our necks on the choppin' block. When do you need the Hueys?"

"Have them at the CP at Tien Phuoc at 0700 in the morning. We'll have an order prepared for the helicopter platoon at that time."

Perhaps this was a little too much emphasis on the spurious remarks of a general, but in the days when the use of armed helicopters was restricted (1964 and before), all forms of *moral* encouragement were required.

The requirement was there and this incident shows how the requirement was fulfilled with the services of four armed Hueys, a little ingenuity, equable judgment, and not to forget, outstretched necks on the block.

For a week the Vietnamese battalion had saturated the valley and ridges to the north and south of hamlet G (sketch 1). Patrols had daily contact with Viet Cong platoon, squads, snipers, and the disconsolate mine. A rich rice crop was about to be harvested and it was a case of "winner takes all."

At least one company of "hard hats" operated from the mountainous jungle extending from D to E to F. Another company operated in the valley to the north of F and followed the inexorable regional command: "Gain control of the people and rice."

Indication that the VC were operating in company strength was substantiated on the Wednesday afternoon in March by direct communications in the form of twenty-odd 60 mm and 81 mm mortar rounds from VC tubes. The rounds landed east of A on a company from the battalion. At the time the other two companies were deployed, one south of A in the valley and the other near B.

"I move one company to C and attack," the battalion commander reported to his boss.

"See if he's been able to locate the VC positions, Thieu-ta."

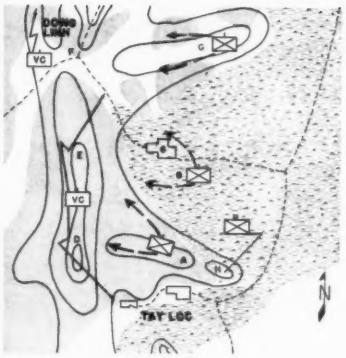
"No located positions, just area. Battalion can't attack until morning. Take time to move."

"That's a good idea to move after dark so that the VC won't see them, Thieu-ta. I'll try once more to get some armed Hueys to support him and maybe even block the VC withdrawal from the area."

"Good idea. We do. You see if you can get 'may-bay' [airplane]."

While the battalion initiated its movement plan to get within striking distance of the suspected VC company, planners at regiment addressed themselves to the command and control problems, as well as the fire support mission to be assigned to the armed Huey platoon. The choppers were to play an intrinsic role in the attack. The plan was flexible to the degree that it would still be carried out without them, should their use be preempted, but reality prevented the degree of success that was desired.

"We must have good air-ground communications and someone from regiment to provide for overall coordination on the scene,



Sketch 2

Thieu-ta. I suggest that the regimental executive officer ride in the platoon leader's Huey and that we attach a PRC-10 radio to the helicopter so that he'll be in the Vietnamese command net."

"We do. Must get helicopters first though."

"Let's keep the control measure simple, yet effective. We don't have time to train everyone, so it calls for simplicity. One of the problems is going to be to identify the lead elements of the three rifle companies.

"This means we have to draw a picture on the ground for the pilots. The picture has to be continuous, since the units will be moving."

"We use lots of smoke."

There was plenty of yellow smoke with the companies, plus some red. It was decided that from the time the Hueys arrived on station yellow smoke would be used to identify the lead element's location. Should the VC use yellow smoke, which they had on occasion, the friendlies would punctuate their signal with red smoke. White smoke was retained for the enemy.

One advisor was to move with the company near A as an additional means of establishing voice

The last Huey was once again airborne, activated for its mission

communications in English. This company would be moving west into the jungle and required this additional commo measure (sketch 2).

"You know, Thieu-ta, if they provide us the choppers we had better make sure that the battalion realizes that these are for supporting their movement to D-E-F and not to do the job for them. This is where the regimental executive officer will be important. He can see the yellow smoke and the movement. If one of our companies fails to move, he can land at the battalion CP and, through the battalion commander, get them moving again."

"Good idea. We do."

"I have Thieu-uy Duoc [Lieutenant Duoc] make plan put PRC-10 radio in helicopter. He good commo officer. We put in right away when may-bay come."

"We should have the battalion select targets for the helicopters, so they don't have to waste time on station waiting for the battalion to give them a mission. We also want to make sure we have a good target direction system, Thieu-ta. Since the battalion CP is a good observation post, we can use this as an orientation point and have them direct all strikes on a magnetic azimuth from there."

"Can do," the regimental commander replied.

"Must get message to battalion right away, so can make plans and get targets," the S-3 said as he scratched with his pen on the fibrous paper in his notebook.

"These guys are really keyed up," the advisor thought. "All I need now is to have the aviation advisor call and veto the whole thing."

YOU'RE ON. 0700 YOUR LOCATION, the message read as the U.S. radio operator decoded it letter by letter.

"We got the helicopter, Thieu-ta! You can let the battalion know we will follow the plan."

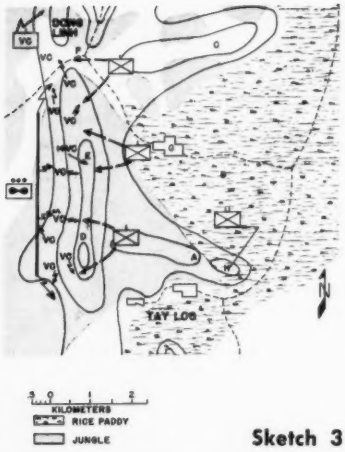
"Battalion already know. I no say 'maybe' when I tell battalion commander about Hueys. I say 'will.' "

It was 0630 and the command group looked up at the slight haze that had settled over Tien Phuoc. There at the landing zone the communications officer was showing his sergeant once more how the radio and antenna would be attached to the Huey. He had drawn a small diagram of the helicopter and was using it to demonstrate the installation.

The S-3 and the advisor studied the four maps which had been prepared for the pilots. The plan had been diagrammed on the four maps and the targets were identified numerically. The communications plan was simple and was spelled out in English at the top of each map. It included the battalion advisors' call sign and frequency.

"We put antenna on may-bay here, with masking tape," the commo officer said to the advisor as he pointed to the landing strut on the diagram.

At 0705 the first Huey touched



Sketch 3

the pad. Twenty minutes later, radio installed and pilots briefed, the last one was once again airborne, activated for its mission.

It was a beautiful sight as the helicopters banked and glided in toward the battalion CP at H. There before them were three splotches of yellow and before they could orbit once, a voice from the ground said, "Dragonfly, this is Watermelon 31. My positions are marked with yellow smoke. Over."

"It's a roger, Watermelon. Do you have a target for me?"

"This is Watermelon, Dragonfly. That is affirmative. Ten Victor Charlie on trail, 310 magnetic from reference point. Over."

"This is Dragonfly. Have target in sight."

Turning his head the platoon leader looked askance at the regimental executive officer for confirmation. The XO had just received the same request from the battalion CO. It was thumbs up all the way around.

"Dragon 2, did you monitor?"

"Roger, Dragon Leader. Have target in sight."

"Dragon 2, this is Dragon Leader. Engage target with rockets. Over."

"Wilco, Dragon Leader. Out!"

And so the fight was on. The VC on the trail were caught by surprise as an armed Huey walloped them with accurate rocket fire in two quick passes.

"Dragon Leader, this is 2."

"This is your leader. Over."

"This is 2. Eight VC remain on trail, definitely. Two got away. Sorry about that. Over."

By then both preselected targets and targets of opportunity were being engaged, after informal coordination aboard the command Huey.

The units on the ground continued to keep their lead elements well identified with smoke. The company on the right near C was lagging and the regimental XO requested that the Huey land at H after a verbal transmission to the battalion CO failed to add any vigor to their movement. What he said to the CO is not quotable, but once in the air again, the pace of this unit livened considerably.

As the command craft swooped up over the mountain near E, a dozen VC bolted across the clearing—the same clearing where seven VC had already been blasted.

"They are withdrawing, Daiuy," the advisor said to the XO as he pointed to the running VC.

"Can use Huey to block?" the XO asked as he brought the palms of his hands together.

"Dung roi! [certainly]" yelled the advisor. With that, the Huey platoon leader assembled his craft for blocking runs on D-E-F and to the west of this line.

For the next 20 minutes the ships roamed from D-E-F to the west and made it untenable for the Viet Cong. Every trail was covered, and several groups of VC in their frenzied forgetfulness exposed themselves. They were blasted. . . .

The VC movement became slow and in desperation some were seen moving towards the yellow smoke and safety (sketch 3).

"It would be nice to stay here on station all day," the pilot said. He knew the time was approaching when he and his other ships would have to move out to the coast and to Da Nang to refuel and rearm. That would take a couple of hours.

"We'll have two more slick ships with us the rest of the day." the platoon said after returning from operations at the field. "They'll ferry ammo out to the battalion CP and a tanker is on the way to Tam Ky to refuel us. That'll keep the VC pucker-factor up."

And it did!

The equivalent of 16 sorties were flown by rearming at the CP and refueling at the tanker. As midafternoon approached, the Hueys continued in their blocking role, engaging VC suspected and observed locations at random. The helicopters gave the rifle companies the opportunity which they were looking for: a VC company with its safe withdrawal route cut off.

Battalion reached the D-E-F area by nightfall and had already counted 31 bodies en route and had captured an equal number of weapons. The VC had thrown away their weapons in their frantic attempt to extricate themselves. One group of 14 VC bodies had been dumped in a pile near E. Next to it the earth had been scratched in order to hide the morale building evidence it would provide to the government unit. The VC failed here, too.

Thirteen VC willingly surrendered to advancing units rather than attempt withdrawal. The battered remnants of the Viet Cong company, 10 to 15 men, escaped. Had the armed Hueys not been available and the rules not modified, there is good reason to believe that the results would have been different. Perhaps the whole VC company might have escaped. But they didn't because they faced the effects of surprise.

The Old Comes Down

THE NEW WAY

I MUST HAVE been plum loco for volunteering for this job," PVT John Nash said to himself. Playing nurse maid to a lop-eared, good for nothing, cantankerous mule*! Come on Nellie, let's get this steel up the mountain. Build a tower they say. What do they want a tower for? To guide some 'dad blame' airplanes. Can't those fool pilots fly without towers to show them where they are?"

Private Nash wasn't the only soldier helping to build the tower. There were many like him, most leading a mule or a team of mules. And it was a long and tedious journey.

The time was the 1920s and fledgling airlines were flying all over the country, and they needed something to show them the way through the desolate air routes of the sparsely settled areas of the west. This was to be a 51-foot light tower on a mountain near Wilcox, Ariz.

Now, after almost 40 years of service, another Army private was involved with the light tower. Three years ago it was decommissioned because of new advances in air navigational aids. It was given to the Air National Guard to be used at Tucson International Airport.

The modern Army private was part of a ground crew of an Army CH-34 helicopter from Libby Army Airfield who had the task of moving the tower down the mountain. He and his buddies detached all ties to the tower except two key bolts. The CH-34 then hovered over the tower for the hookup. The key bolts were pulled, and the helicopter carried a section at a time down the mountain in four operations.

What took PVT Nash months of backbreaking work to do took his modern-day counterpart only minutes. The beacon light tower that once lit the way for pilots gave way to modern man and his machines.

For nearly 40 years this light tower (above) guided aircraft pilots over the Chiricahua. This shot was taken just before a CH-34 helicopter from Libby Army Airfield begins to lift off parts of the tower near Benson. It took weeks to carry the parts for this tower up the mountain back in the 1920s. It only took a day to dismantle it

*This is not Nash's own description of his mule. Each mule skinner has his own version of oaths, and PVT Nash's can't be printed in the magazine.

HOME EDITION

EL SOL de M

Vol. XXI, No. 271 Thursday, September

Chinook Aids Hurricane Beulah Victims

Mexican Newspaper Praises U.

EDITOR'S NOTE: Following hurricane Beulah last September, a Mexican newspaper reporter accompanied a U. S. Army rescue team flying a Chinook. The reporter's story of the fine job done by the Army was printed on the front page of EL SOL de Mexico, the newspaper for which he was writing. The story appeared on September 28 and read as follows.

★ ★ ★

By Vicente Morales
Special to EL SOL de Mexico

ON BOARD HELICOPTER 619122 of the North American armada, Sept. 27—This gigantic apparatus, similar to those used by the North American Army on important military missions, is one of those utilized for "Operation Friendship." It carries six tons of food and medicine and about 40 people, counting the technicians, doctors, the ill and brave people from the Mexican towns who go to the rescue of those injured by the flood on both sides of the Bravo river.

In this zone hours of unmistakable anguish have been endured. The North American Lt. Col. John Cunha and Manuel Garza Gonzalez, PRI chief in Reynosa, head the mission.

Gonzalez who is the classic type of northerner — strong, frank and candid — has just informed us that they have received a report from the pilot concerning a reconnaissance flight, judging from which various towns and hamlets of western Tamaulipas and Nuevo Leon have been isolated for seven days by floods.

It is felt certain that those people have no drinkable water or food, and it is feared that epidemics have broken out.

AT 1403 HOURS the double windmill wings began to turn on the "Chinook," the name given to this type of helicopter, the largest of the North American Army, and seconds later, the huge bulk, weighing almost 20 tons, lifted vertically with astonishing ease.

The apparatus makes a deafening noise. It is not possible to hear the human voice or any other sound except the high-pitched beat of the wings.

Dr. Louis Sanchez Navarro, of PEMEX, who is carrying almost a half ton of medicines for distribution among the injured, is obviously exhausted but ready for action. On the other hand, nurses Silvia Ostos and Luz Maria Gamboa talk without stopping and smile continually.

Below, everything is a sea. The water everywhere half covers large cultivated fields and urban areas. It looks like the shores of the Gulf of Mexico have changed and that an immense harbor exists in the states of Tamaulipas and Nuevo Leon!

NEITHER THE roofs of the houses nor the treetops are visible. Everything is beneath the muddy water, with its accentuated dirt color.

The Bravo river now has no bed. It is as though the border between Mexico and the United States has disappeared. The river is now one big lagoon, whose beginning and end can't be determined.

There are some spots through which the railroad passes. The embankment was elevated, but the water levelled it. The railroad resembles the ribs of a skeleton, for in many places there is nothing to support the crossties. They are floating upon the water.

Steel bridges are left doubled, bent like tin plates. It will be necessary to reconstruct them for railroad passage.

The Reynosa-Matamoros vehicle road is cut in many sections. It looks like it was blasted with dynamite purposely to permit the passage of water. But it was only the torrential flood that destroyed it.

WITH THEIR military helmets and work clothes, the North American military are in agreement with Gonzalez and with other leaders in regard to the zone over which they are flying. On maps spread over their knees, they try to locate the lost towns.

There are seven helicopters like this one which the Fourth North American Army has sent to Reynosa to collaborate in the rescue of the injured. Participating in addition are more than 20 machines from the Mexican Army and from official and private business to perform a task as dramatic as this.

The operation of a "Chinook" costs $1,000 per hour (12,500 Mexican pesos). They fly an average of 16 hours daily.

Capt. Rafael Morales, a Puerto Rican who speaks good English and Spanish, is the coordinator of "Operation Friendship," together with Lt. Col. Gregorio Ramos.

The envoys of El Sol de Mexico are the first to have the opportunity to travel on board a "Chinook."

"THEY HAVE to help lower packages and distribute food. The op
this is
cannot
thing i
both si
accept
ing at
go on
a court
ner. An
the con

The
copter,
ha, ha
World
nam. H
He is c
age cau

It is
all pers
ready b
the first

After
town o
the heli
The p
seemed
to the
run thr
signals
ing shi

A la
mined.
up by t
helicopt
Mr. Go
scend.
place w

Mexico

28, 1967 10 Centavos

.S. Army Mission Of Mercy

peration of a machine like very expensive and we carry dead weight. Every- is to aid the injured on ides of the border. If they to help and to do report- the same time, they can board," we were told in rteous, but positive, man- nd we cheerfully accepted nditions.

commander of the heli- Lieutenant Colonel Cun- as been in three wars: War II, Korea and Viet- He is kind and courteous. concerned about the dam- used by the flood.

s he who announces for sonnel on board to make because we are arriving at st isolated town.

r circling twice over the of Madero, Nuevo Leon, licopter approaches land. people, after what has l a long time of listening noise of the helicopter, rough the streets, making with their hands and wav- rts and colored clothing.

anding spot was deter- The gusts of wind stirred the windmill wings of the ter cause waves of mud. onzalez is the first to de- He lands in a muddy which comes up to his knees. He advances painfully, swayed by the wind that is caused by the rotary wings of the helicopter.

MY COMPANION, photographer Lorenzo Hernandez Borboa, follows him immediately. At the first step he loses a shoe (all the others carry miners' boots) and is at the point of losing his balance because of the weight of his cameras and telephote. Nevertheless, he masters the situation and begins to operate his machines.

Children, women and elderly draw near. They know that help has come. Food, water and medicine that they have hoped for so much.

The waves of mud that lift the helicopter spatter the clothing and faces of the people. Nevertheless, they reach up to the back part of the machine and begin to receive their provisions. There are boys and old men who fall; the helicopter cannot spread out its windmill wings because they have sunk in the mire.

The doctor checks over the town. They tell him that only a few hours ago the village became flooded. There is no dry clothing and the 120 families that live there have just descended from a hill where they took refuge from the torrent.

For five days they have lived under these conditions. They had eaten drowned chickens or hogs and the sparse provisions which they managed to pull out of their homes before the flood.

THERE ARE beautiful girls and strong young men, who tell the doctor that there has been no serious illness. There is only influenza and diarrhea. The doctor lowers from the helicopter a box containing medicines and explains how and when to use them.

Meanwhile, the helicopter crew has supplied 120 sacks (bags) with provisions from the CONASUPO. They contain flour, tin plates, sugar, milk and other foods—enough for a person to live on for five days. "It is not for stuffing yourself, but for survival," Mr. Garza Gonzalez tells them.

The people look at us with gratitude. There are some women who weep with joy. They lived in fear of being isolated and without food for their children.

"It is my request," Garza Gonzalez says to them, "that you write to the President and give him your thanks. He has ordered that all these things be brought to you. He is very concerned about you and will not forget you."

In eight minutes the entire operation has been performed.

After 15 minutes aloft we find another settlement cut off by the water.

THE HELICOPTER descends on what was an Indian-corn field. This time we stop near the village which from the air appears to be totally destroyed: homes tilted to one side or tumbled down into a sea of mud.

From the only building that stands the people come out. Children, very well developed, come to wander about the helicopter. Here the land is more solid, and the engines and turbines of the Chinook are stopped.

On cessation of the noise, little childlike voices can be heard harmonizing the National Hymn. The North American soldiers who are on board at work ask: "What is that singing?"

On learning, they discontinue all action and movement and stand at attention before the half-naked children as they sing "A soldier in every son of God"—

There are tears on many faces. The Americans appear repentant and to have a lump in the throat.

Continued on page 64

Selling the Exotics in CI Operations

Our country's history has often been tempered by the peculiar breed of soldier who attempts to improve the status quo—men who seek ways to prove the worth of new equipment, tactics, or techniques without seeking personal recognition. This is the story of such an individual's contribution

Lieutenant Colonel Donald P. Frandsen

IT WAS A MOONLESS night in April 1965 when the section leader and his observer took off in the OV-1B Mohawk. Their mission was to provide SLAR (side looking aerial radar) coverage of most of the 3d Vietnamese Corps, most specifically those areas known as war zones C and D.

Until this flight, SLAR had not been sold as far as counterinsurgency operations were concerned. Older methods were depended on for night aerial surveillance. SLAR had always been thought of as useful for detecting mechanized and armored units in mid and high intensity warfare. But Captain John R. Connelley, the SLAR section commander, knew that SLAR had a place in this type of warfare—and that it was going to be up to him to sell it.

The equipment carried aboard the OV-1B was good, but its capabilities and limitations were for the most part unknown to the commanders and staffs of the units it was supporting. Captain Connelley was determined that its capabilities would be known and that it would benefit the counterinsurgency effort.

Since he flew night missions, Captain Connelley had used his free daylight hours to contact the various U. S. Army G-2 advisors in the 3d RVN Corps area. He explained SLAR operations and coordinated the use of radio frequencies and call signs with them. He even contacted the U. S. Navy advisors with the RVN Junk Fleet and arranged to report coastal seaborne targets directly to them.

It was understood that while flying the approved preplanned missions for the MACV he would report target sightings to those tactical units over which his assigned missions took him. He would not deviate from his MACV approved mission without permission.

Now the OV-1B was airborne and had begun the initial SLAR run. Imagery was already showing on the built-in light table (properly the RO-166 Recorder Processor Viewer). The radar map was taking shape and familiar land-

---

COL Frandsen was evaluating the "Firefly" system in Vietnam when the mission described took place. He is presently chief, Studies, Research and Analysis Division, Dept of Tactics, USAAVNS, Ft Rucker, Ala.

marks were noted—especially the heavy traffic of the Saigon-Cholon-Bien Hoa area, which was showing up as a mass of moving targets. All friendly, of course.

Suddenly, three significant targets appeared on a river that was identified as the Oriental River—several kilometers west of Saigon. This area was under curfew restrictions and all river traffic could be assumed to be Viet Cong. Coordinates of the targets were quickly determined by the sensor operator, and their positions were immediately radioed to the U. S. Army G-2 advisor with the 25th ARVN Division.

Captain Connelley was informed that his targets' location coincided with that of a friendly outpost presently under a fierce attack, and that river traffic in this vicinity was not known to the defenders. He was requested to keep this area under surveillance until some relief could be effected.

MACV personnel quickly gave permission for him to abandon his preplanned mission so he could remain in this critical area. Since the characteristics of the SLAR did not require the aircraft to fly over or even near the target area, the Viet Cong on the sampans were unaware that they were under surveillance.

After making several flight paths many kilometers east of the target area, a U. S. Air Force C-123 flare ship and two armed UH-1 helicopters of the 197th Aviation Company (AML) arrived in the target area. (The searchlights used on "Firefly" operations were still under evaluation at this time.) The targets were illuminated and immediately identified as being three sampans. The Hueys attacked with rocket and machinegun fire, sinking all three sampans. One sampan exploded when hit by this devastating fire.

The attack on the outpost was immediately broken off. It can be surmised that the sudden illumination coinciding with the terrifying rocket and machinegun fire caused considerable doubt among the attacking Viet Cong as to the loyalty of their own personnel. After all, how else could the sampans be located, illuminated, and destroyed so quickly?

The success of SLAR during the following weeks of providing surveillance of night river, canal and coastal seaborne traffic wreaked havoc with the Viet Cong's supply transport system. A new and important role for the SLAR section was born. No longer were there doubts as to its place in counterinsurgency operations. The various U. S. Army G-2 advisor personnel along with U. S. Naval advisors could not get enough SLAR surveillance missions.

The unpublicized accomplishments of sensor equipped aircraft and their crews are part of the game. However, all tactical commanders and their staffs should become knowledgeable enough to know what an aerial surveillance unit can and cannot do for them.

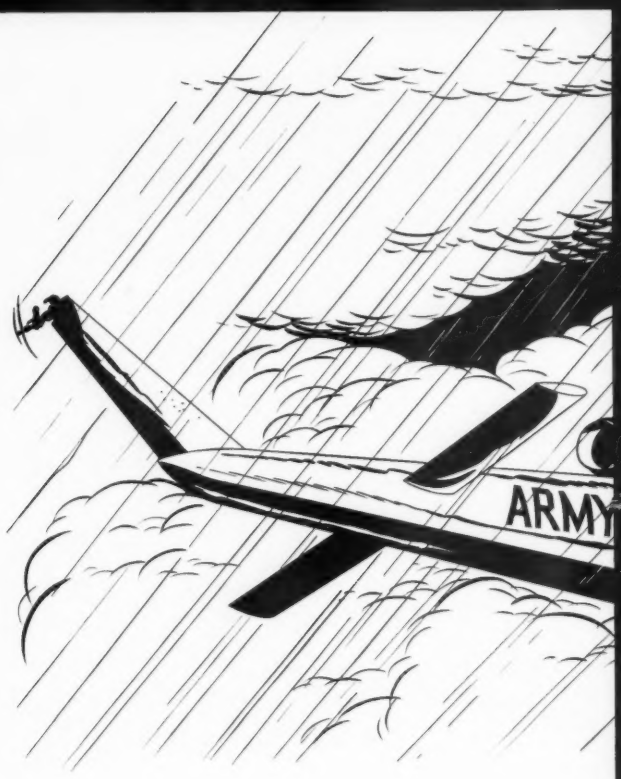
Captain Connelley assured himself that those units he supported knew the capabilities and limitations of his equipment. He and his enlisted sensor operator (whose name is unknown to this writer) deserve much credit for initiation of what was later called Lightning Bug (now Firefly) operations.

Bad News For Tanks

Mounted on both sides of the UH-1B helicopter is the XM-26 subsystem which will fire TOW guided missiles. Each pod carries three missiles. Airborne TOW is being developed to destroy heavy armor and other infantry targets. The system features a stabilized sight, developed by Hughes Aircraft Company, prime contractor, which counters movement of the helicopter. The TOW program is managed by the U. S. Army Missile Command, Redstone Arsenal, Ala. TOW missiles have scored hits on moving tank targets at ranges of more than a mile in tests at Redstone Arsenal.

RESCUE

". . . I heard the pilot of the rescue ship say that he could not get to the pickup area because of the weather."



UH-1B aircraft commander: ". . . A helicopter had crashed in the area and word reached us that a rescue ship was coming to pick up the downed crew. The weather to the north was deteriorating rapidly and, since I was low on fuel, I decided to go to a refueling point. Just as I arrived at the refueling point, I heard the pilot of the rescue ship say that he could not get to the pickup area because of the weather. Since the bad weather had not yet arrived in the operational area, I told him that I would make the pickup and immediately returned to the site of the downed aircraft. . . . When we started back for the refueling point again, we had only 350 pounds of fuel.

"The refueling point was clearly visible until we were nearly 2 kilometers away from it. Then the weather closed in and I lost sight of the landing area. I called and asked them to turn on their lights and to have my wingman turn on his position lights so I could see his location on the field. As I passed over the tank farm it was raining hard, but I could still read the sign on the oil tanks.

"I saw the lights come on, but was too high and too close to make an approach, so I continued west down the river and made a right turn back to the landing area. . . . The pilot tried to turn on the windshield wipers, but they didn't work. I had the landing light and searchlight on when the rain closed in like a sheet around us. I slowed up and was, I believe, at a hover when the crewchief told me we were close to the water. I pulled pitch and felt the left skid hit what I thought was the ground. The aircraft pivoted to the right and went into the water and sank.

"My next thoughts were of getting out of the aircraft. I looked for a hole but the ship was intact. I released my harness and went over the back of my seat, grabbing anyone I could find and pushing them out the cargo door. When I surfaced, several people were sitting on the skids of the inverted aircraft. I asked who was missing and the crewchief said the gunner wasn't there. I went down into the ship and brought him to the top about 6 feet from the skids of the aircraft. He was struggling violently and someone was trying to help me.

"I got behind him and tried to keep his head out of the water, but the current was drifting us away from the ship very rapidly. I became too tired to hold him, so I went to the bottom and pushed him up by his legs. I did this several times and he would kick himself out of the water. This continued until his legs would not respond when I pushed up

CRASH SENSE

the following 28 pages prepared by the U.S. Army Board for Aviation Accident Research

and I could no longer reach the bottom when I went down. I lost him and could not find him again. I tried to swim back to the ship but I was too fatigued, so I removed my boots and floated with the current until I was picked up."

Pilot: ". . . We reached the landing area and began a descending turn to the right. We could see the lights of some ships moored in the river. We were descending too fast and I mentioned it to the aircraft commander. He said OK and stopped the descent at approximately 400 feet indicated. We made a 360° and came over the pad again, but we were too high to land so we began another circle. At the aircraft commander's request I had tried several times to turn on the windshield wipers, without success. I tried again, but they would not work.

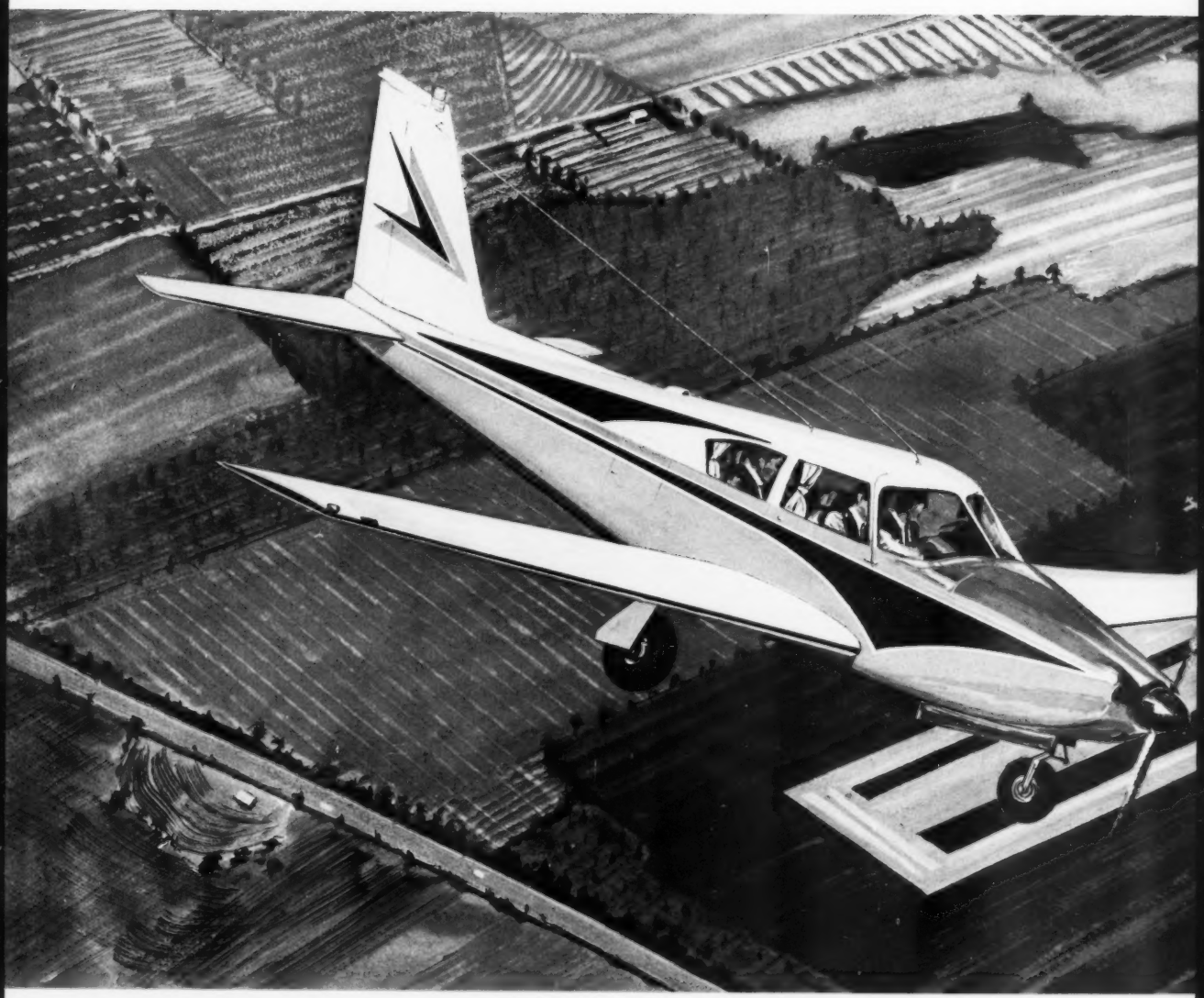
"The last instrument readings I can recall seeing before we hit the water were the airspeed at 80-85 knots and the altimeter at 200 feet. Then we touched down on our left skid and rolled to the right. I tried to swim and realized that I was still strapped in. The water filled the cockpit and after I released myself from the seat, I became caught in my mike cord. I removed my helmet and hit the panel while searching for the window. Then I hit the roof and got stuck between the seats. I finally got loose, but had run completely out of air when the aircraft commander reached through the window and pulled me out by the scruff of my neck. . . ."

Analysis: "The board determined that the aircraft commander made two decisions which led to the accident. They were (1) to turn back and attempt to evacuate half of the crew of the downed ship from a secure position when the weather was deteriorating, and (2) to continue the approach when visual contact with the landing area was lost.

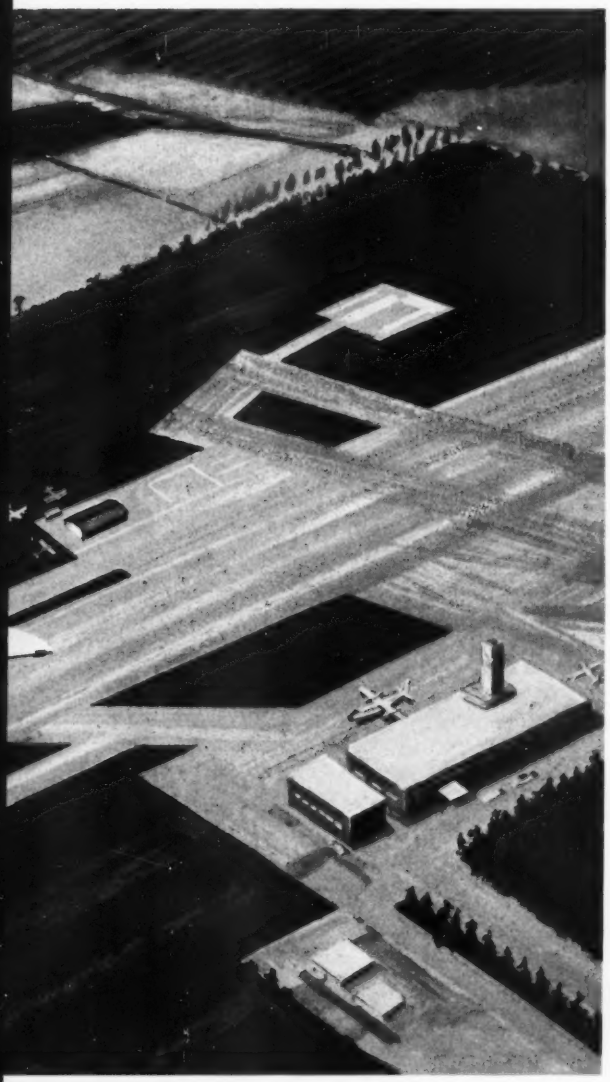
"The board felt that the first decision was prompted by the natural desire of all aviators to assist downed crews, and that to be critical of this decision would be taking advantage of hindsight which was not available to the man making the decision. The board also felt that both decisions were aggravated by fatigue. This aircraft commander had flown 105 hours in the previous 30 days — 34 of these at night — and had been up since 0430 on the day of the accident. . . .

"The board further concluded that the second decision was directly influenced by the weather and fuel remaining on the aircraft. Both of these factors limited the courses of action available to the aircraft commander and had the effect of making the decision for him to continue the approach."

FLIGHT FOLLOWING-CANCELLED!



. . . available flight following service was cancelled . . . the accident occurred at approximately 1612 hours but not found until 1400 the following day . . .



INVESTIGATION NARRATIVE: "This accident involves a civilian single engine fixed wing contract airplane flown by an Army aviator not on active duty, with two passengers aboard. The pilot filed his flight plan with a flight service station by telephone, estimate 3 hours en route, and requesting that the destination commander be notified of his ETA. Takeoff was made at 1300.

"The accident occurred in a wooded area approximately 100 feet south of the runway at the destination airfield. Tachometer readings indicated the airplane had flown an elapsed time of 3 hours and 12 minutes before the crash. The airplane was seen by three people at separate locations. The altitude at this time was estimated to be 200-300 feet and the witnesses said it was apparently having engine trouble, described as erratic rpm. The area in which it came to rest measured 40 x 50 feet, surrounded by 40-50 foot pine trees, with a few wild plum trees. The surface had a grade of approximately 4 percent away from the runway and the airplane was in such a position that it would not be easily seen by a passerby.

"The airplane hit in a nose low attitude of approximately 80-85° and initial impact was on the leading edge of the right wing, engine section, and tip of the leading edge of the left wing. The tail section broke off just aft of the baggage compartment displacing to the right. Control cables to the elevator and rudder had no visible damage. The propeller was found with one blade inserted in the ground at a 28° angle and the other blade was slightly bent to conform to the ground contour. The engine mounts were broken from the firewall attaching points at three places. The propeller shaft was broken completely in two and did not evidence rotation at impact. After initial impact, the airplane bounced rearward and to the right 12 feet and came to rest.

"The accident occurred at approximately 1612 and was not found until 1400 the following day,

FLIGHT FOLLOWING-CANCELLED!

". . . it is quite likely that the deaths of both passengers could have been avoided had rescue been prompt."

as a result of a telephone inquiry from the pilot's unit."

Investigation: ". . . The witnesses all stated that the aircraft was seen low over the trees and apparently having engine trouble. There were no witnesses who saw or heard it hit the ground.

"The fuel cells were not ruptured during impact. The left cell was found to contain 25.5 measured gallons of 100/130 octane fuel, and the right tank was empty, except for 1 pint. The fuel selector valve was positioned on the right tank and functioned properly as installed and when removed from the airplane. The fuel boost pump switch was in the on position and the fuel injector and fuel flow dividers were not damaged.

"The leading edge of the right wing was compressed two-thirds the length of the wing from the tip inboard. The left wing had only tip damage and some skin wrinkling. The main landing gear was not damaged. The nose gear was broken off at the mounting point, but not otherwise damaged. . . . All control surfaces functioned properly and had adequate freedom of movement.

"A search of the surrounding area established little or no debris pattern, except for some plexiglass from the windshield which was broken at impact. This was found very close to the propeller. . . .

"The engine and airframe records were studied by all board members and nothing significant to their maintenance history was discovered. The airplane had only 258 hours since new.

"Fuel samples taken from the fuel tanks were visually checked at the time of removal and appeared free of contamination. Some contamination was found when the fuel was analyzed, but the board believes this was the result of condensation. Oil samples were not available because the oil sump was damaged at impact and the oil drained on the ground.

"The engine, fuel boost pump, fuel selector valve, and engine instruments were flown to a laboratory for tests and analysis. These tests proved the engine was not developing power at the time of impact, that all engine components were functioning properly, and that the engine had very little wear pattern. A black light test showed the fuel pressure gauge read zero and the suction gauge read less than 1" Hg at impact.

The cabin had little real damage, except for the impact forces which displaced the instrument panel. The roof of the cabin had a saddle break midway and in line with the cabin door."

Analysis: "From the available data, the board eliminated aircraft design, maintenance, inspections, and materiel failure as possible cause factors. The area of primary concern was crew performance resulting in fuel starvation, and the related factors that could have contributed to the cause. The operator's handbook for this airplane warns the operator to use fuel from the left wing tank for the first 15 minutes of flight, before switching to the right wing tank. The fuel pump provides fuel in excess of engine requirements and the surplus fuel is pumped into the left tank at a rate of approximately 6 gallons an hour. The airplane checklist warns that at least 15 gallons should be used from the left tank before switching to the right tank, because of the overflow return. The procedures in the handbook and checklist are contradictory. However, elapsed time of the flight indicated that the procedures outlined in the checklist were used. Another pilot who had flown the same airplane before and failed to use the correct procedures stated that he had exhausted the fuel in the right tank and had considerable difficulty restarting the engine. It was established through records and statements that the pilot involved in the accident had flown the airplane over the same route and had previously run fuel consumption tests. It was therefore assumed that he knew the proper fuel management procedures. With this assumption and other available data, the board believes the following took place:

". . . Following proper procedures, the pilot took

off and cruised for approximately 1 hour and 30 minutes, using fuel from the left fuel tank. At normal consumption, this required approximately 15 gallons of fuel. The pilot then switched to the right tank and left it there for the remainder of the flight. At the established consumption rate of 9.83 gallons per hour, plus 6 gallons per hour overflow to the left tank, endurance on the right tank would be approximately 1 hour and 42 minutes. This coincides with the elapsed time from takeoff to crash.

"The pilot closed his flight plan with a flight service station over a VOR and continued toward his destination airfield. Arriving from the northwest, he made a left turn on downwind to the east for left traffic and a landing on runway 27. Preoccupation with thoughts of local traffic, the proper runway to use, and how to cope with a strong southwest wind (15-20 knots), resulted in omission of a proper downwind cockpit check.

"After crossing the west boundary of the airfield, on the downwind leg, the engine began running rough and stopped because of fuel starvation due to exhausting the fuel in the right tank, at approximately the halfway point of the downwind leg. The relatively high compression of the low-time engine and low airspeed in preparation for landing, together with misinterpretation of the emergency or slow reaction time, allowed the propeller to come to a complete stop. Since low altitude and airspeed would not allow for an engine restart, the pilot elected to try to land within the airfield complex. The airplane was turned left to a heading of 345°, stalled into a nose low attitude, and crashed into wooded area short of the airfield.

"The fact that the airplane had not arrived safely was not discovered until a telephone call was placed by the home unit to the destination. . . ."

Though the pilot had requested that the commander at his destination be notified of his ETA, he filed a civilian flight plan and was flying a civilian airplane, using civilian identification. The FAA does not transmit the "remarks" section on civilian flight plans. Army pilots can have information transmitted to their destination by filing an Army aircraft identification and by using "Army" in the call sign of civilian aircraft, such as "ARMY NAN 1234, etc." This will ensure that requests to forward information in the "remarks" section of flight plans are honored.

Because he did not follow this procedure, and because he closed his flight plan in the air before attempting to land, available flight following service was cancelled.

Flight surgeon: ". . . The accident was not discovered until the early PM of the day after. Upon discovery, all occupants were dead. The pilot was jackknifed forward, with his head lying against the right control column and the left control column to his left. The right handle of the left control column was broken off and the recovered piece showed blood and skin particles, while the aviator had a 3 cm defect in the mid-forehead. The panel was firm against the legs of the pilot and the passenger in the copilot's seat. The passenger was found with his head outward on the right wing. The back seat passenger was on the right and was jackknifed forward, with the vertical portion of the back seat and the luggage pushing him forward. The restraints for this portion of the back seat were bent forward, allowing this section of the seat to leave its normal position.

". . . The coroner reported that the back seat passenger had only facial lacerations, a fractured jaw, and swollen eyes. The passenger in the copilot's seat reportedly had a crushed chest, facial lacerations, especially about the mouth, a compound fracture of the left tibia just distal to the knee, and a possible neck fracture. It is my belief that it is quite likely that both of the passengers died respiratory deaths which could have been avoided had rescue been prompt."

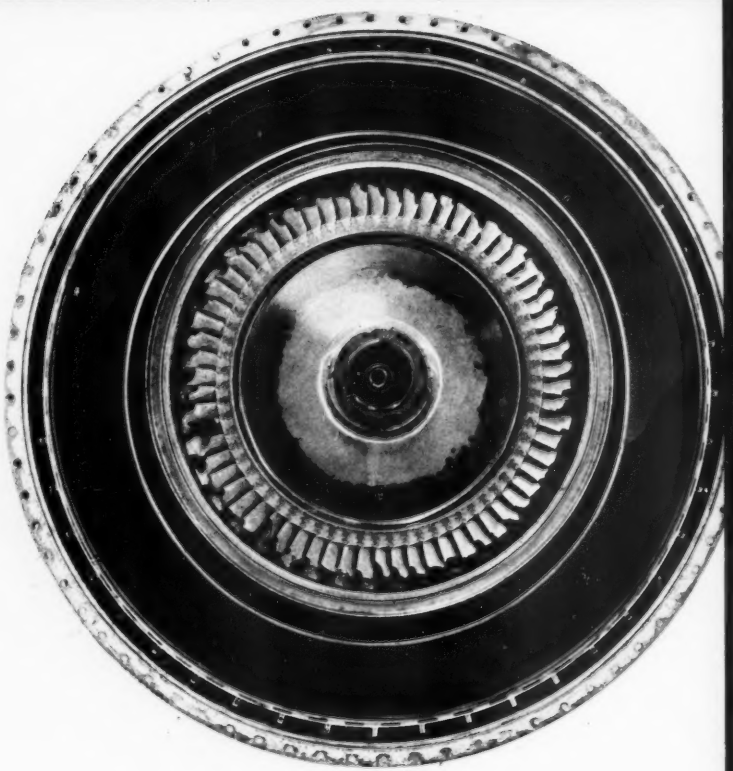
The board listed fuel starvation and inadequate fuel management procedures as established cause factors for this accident. It listed probable or suspected cause factors as failure to properly analyze the emergency, slow reaction to the emergency, poor flight planning, insufficient training in the airplane, and poor human factors consideration in the design of the fuel system.

According to his DA Form 759, this aviator had only 8 hours in the airplane before beginning this flight. Of these, only 2 hours were listed as training and 1 of these 2 hours was logged while flying hood. The remainder of his flying time in the airplane was all cross-country and he had recorded only five landings. Paragraph 11d, AR 95-4, states: "Except when otherwise specified, unit transition training required to qualify an aviator for operation of particular types and models of standard Army aircraft will be conducted in accordance with appropriate DA training circulars. As minimum, this instruction will consist of 10 hours of flight training and appropriate training circular."

While this was a civilian contract airplane, the cause factors listed for this accident indicate the need for all aircraft to comply with this regulation.

conglomeration of errors

Engine failure could have been caused by any one or by any combination of maintenance shortcomings



Inspection was overdue and aircraft was destroyed when blades failed from undetected discrepancies

UH-1B pilot: ". . . The first indication of trouble was a loud noise coming from behind me. It was not like an explosion. My first thought was that I had lost the tail rotor and I intended to fly it out. Almost immediately, I realized that I had not lost the tail rotor because, immediately after the noise, the aircraft was almost uncontrollable. At the same time, it seemed greatly out of balance. It was not an oscillation, but more of a combination of an oscillation and a vibration. It did not seem to be predictable.

"I attempted to maintain flight, but the aircraft would not do so. . . . I spotted a less densely wooded area and made a slight turn to the right to line up on it and, at the same time, zeroed the airspeed and dropped vertically through the trees. We had no forward motion on impact.

"Immediately following the loud noise and severe vibration, I made a radio transmission and alerted the other aircraft that we were having difficulty and were going into the trees. The accident reminded me of doing a high hovering autorotation. The control difficulties never ceased. There was no power available during the descent. I could not stop it. I did slow it, however, and at about 5 or 6 feet, the aircraft fell out from under me."

The helicopter was destroyed. The only injury was to a passenger who had removed his helmet to adjust the neck strap. He was cut on the head by a metal fragment of the collapsed ceiling structure.

Investigation: ". . . The pilot stated that, prior to the crash, this particular aircraft was very smooth, with little or no vibration. He further stated that he had aborted a takeoff on the day prior to the accident because of rpm bleedoff. At the time of the aborted takeoff, he stated that the aircraft was carrying himself, the crewchief, the guns, and a full fuel load. The pilot stated that he accomplished a successful takeoff on the second attempt. . . .

"Several photographs of the aircraft were taken from various angles. After the photographs were taken, the trees which were covering the aircraft were carefully removed. It was noted that a small hole was torn in the right hand engine cowling. The marks on the cowling indicated that an object had penetrated the skin from the inside. The engine and transmission cowling were then removed. There was a large amount of grease noted on the

conglomeration of errors

inside of the transmission cowling in the vicinity of the short shaft housing. The short shaft itself was found relatively intact on the transmission deck. A 7.62 mm projectile was also found on the transmission deck. A 3/8-5/16 open end wrench was found on the engine deck. The engine intake screen was examined and found to be intact.

"A search of the area surrounding the wreckage revealed a large amount of main rotor blade pieces scattered over a semicircular area approximately 250 feet in radius, primarily to the rear of the aircraft. Pieces of the short shaft retaining clamp were found directly in front of the aircraft. One red blade tip balancing weight was found directly to the rear of the aircraft at a distance of 150 feet. . . .

"The board reviewed the aircraft maintenance records. The maintenance records of this aircraft reflected a confused and unorganized equipment records procedure that did not follow the instructions in TM 38-750.

"At the time of the crash the aircraft had an M-16 armament subsystem installed. The weight and balance records did not include this installation.

"There was no record of the completion of the No. 3 periodic inspection, due at 299 hours. The inspection was written up as due on the 2408-13. Block 18, following the requirement, noted 'entered in error.' The next dated 2408-13 indicated No. 4 PE due at 394 hours. The maintenance officer stated that the No. 3 PE was performed. The crewchief stated that he performed 'a very rushed periodic inspection.'

"The maintenance officer stated that his PE crews were working on a three shift basis around the clock at the time that the No. 3 PE was performed, and that the crewchief could not have known how the No. 3 PE was performed, since he did not remain with the aircraft for the entire 24-hour period. The 2408-13 had several entries which indicated that the PE was performed in some degree, although the proper entry for completion and the PE worksheet were not filled out.

"The aircraft became 02:20 hours overdue for a No. 2 intermediate inspection during the flight which terminated with the crash.

"The 2408-15 engine entry indicated 165 hours on the engine at the time of installation. The engine time was entered on the 2408-13 at zero. Later, the 2408-13 engine time was changed to same as the airframe time, which was also incorrect. A check with the factory revealed that this engine was sent to them for minor repair. The factory shipped the engine with 165 hours of operating time.

"The power rating placard (located in the cockpit) of the installed engine was incorrect. It apparently was not updated to reflect the correct figure for the currently installed engine.

"All members of and advisors to the board agreed that the writeup on the 2408-13—'governor fails to adequately control rpm'—a month before the accident should have been more aggressively pursued and corrected, rather than allowed to be carried forward for such an extended period of time. When asked why this discrepancy was left on the 2408-13, the maintenance officer explained that he had test flown the aircraft to analyze the problem. During the test flight he was able to decay the engine rpm by only 100 rpm, while performing a power check of the engine, with the aircraft fully fueled. After burning off several hundred pounds of fuel, another power check was made. That time the decay in rpm was only 50. The maintenance officer further stated that he did not feel that the condition of the engine was serious, but that he would leave the writeup on the 2408-13 so that other aviators would be aware that a problem with this engine had been experienced.

"The fire extinguisher weight test was overdue. This discrepancy was not carried in the 2408-13.

"All engine accessories listed on the 2408-16 reflected incorrect 'installed at' and 'removed at' times.

"The profusion of errors in the maintenance records confused a true picture of the maintenance program which was supporting this aircraft.

"An unfortunate number of crewchief changes were made. In a period of 3 months, terminated by the crash of the aircraft, there were four crewchief changes, involving three personnel. This did not allow continuity.

". . . the main fuel line connector to the main fuel manifold was about 3/4 turn loose. Evidence at the short shaft tunnel cover and deck of the aircraft indicated a serious fuel leakage. Number 3 and 4 oil scavenge line connectors were also found loose. The oil in the main oil reservoir was very dark and had evidence of a fibrous type substance. When the main fuel filter was broken open, it was found that the cannister contained foreign objects, sand, grit, and flakes of yellow paint. . . .

"During the dissassembly of the hot end, it was found that the right hand igniter plug was finger loose and not safety wired. The cover of number 3 and 4 bearing package had one of the allen head screws lying loose in the inside cover. Four of the

screws were finger loose and the remaining six showed very little torque. Upon removing the cover, it was found that the two 10/32" flat retaining screws on the outer plate were backed out 2½ turns.

"Further disassembly revealed the through bolt to be finger loose and, upon removal, sheared from torsion at the last thread joint. There was some evidence in the sheared section of circumferential rubbing on the tips. Three points had high temperature purple bowlegs. Following the removal of the combustion chamber flange bolts, it was learned that the stub shaft of the power turbine had been sheared in the vicinity of the air seal.

"N_2 nozzle retaining screws and tap washers were strewn throughout the combustion chamber. All blades of the N_2 turbine were broken in a shock-wave pattern, at varying lengths. The N_1 turbine blades were broken approximately 1/2 inch from the tips, except for one which was broken at the platform. Also of significance is the N_1 turbine disc which was cracked in the vicinity of one of the slots for the locking wrench. The compressor section showed some evidence of erosion, but was relatively intact. . . ."

Analysis: "The board initially felt that this accident was the result of a simple engine failure. It was determined, however, that it would be absolutely essential to investigate and determine the cause of the severe vibration in order to evaluate its possible significance to the accident. . . .

"From the overall poor maintenance condition of the aircraft, it was apparent that engine failure could have been caused by any one, or by any combination of maintenance shortcomings. Due to the substandard maintenance condition of the entire aircraft, the eventual failure of this engine was very probable.

"Several of the maintenance discrepancies discovered during the dissembly of the engine could have been detected or caused only during assembly or during the course of a hot end inspection. The board interviewed the platoon sergeant of the aviation company. He stated that the aircraft was assigned to his platoon and that he was very familiar with it. He stated emphatically that he was certain that the hot end of the engine had not been disassembled since it was installed. Since the hot end was not disassembled since installation, the board can only conclude that this engine was installed with several maintenance discrepancies existing.

"It is also possible that had the number 2 intermediate inspection been properly performed at the correct time the loose fuel line connection might have been discovered and corrected. This condition may have contributed to or caused the bleedoff of rpm on the day prior to the accident. This could also have contributed to engine failure.

"The board considered the pilot's statement concerning the aborted takeoff on the day prior to the accident of special significance. The board felt that, had he made this fact known to maintenance, and had maintenance corrected this condition, this accident may have been prevented. . . . The board unanimously agreed that this aircraft should not have been released for flight. Although not contributing to the accident, an additional item of significance was the error of the personnel who replaced the engine without entering the previous engine time in the 2408-13. If the engine had not failed, it might have overflown essential inspections. . . .

"The pilot, faced with the combined emergency of an engine failure at low altitude over wooded terrain and a severe vibration, remained calm and in complete control of the situation. He selected the least densely wooded area within the helicopter's area of capability, maneuvered towards this area, and continued to fly the aircraft until it contacted the ground. Had it not been for the exceptional flying ability exhibited by the pilot, this accident could have resulted in loss of life. Also of significance was the fact that the pilot made a radio transmission to alert the other aircraft of his situation. This radio transmission could have been extremely vital had the aircraft caught fire or had the occupants been incapacitated."

Findings: Engine failure was caused by failure of N_1 and N_2 turbine blades. The board listed the following contributing cause factors:

"1. Maintenance supervisory error. In the opinion of the board, the general overall substandard maintenance condition of this aircraft was a definite contributing cause of the accident. A portion of this substandard condition existed since installation of the engine and was caused by maintenance error at other than unit level.

"2. Maintenance inspection error. Maintenance inspections were not accomplished at the correct hour level in accordance with appropriate directives. It is highly possible this accident may have been prevented if a proper No. 2 intermediate inspection had been accomplished.

"3. Pilot judgment on the part of the pilot for flying with known serious maintenance deficiencies, i.e., failure of governor to adequately control rpm and the fact that the aircraft, even though lightly loaded, had insufficient power for takeoff in a formation flight on the day prior to the accident."

Preliminary checks ruled out the possibility of sabotage and drew attention to the relatively new nickel-cadmium battery.

SEVERAL YEARS AGO, a deafening explosion in the nose section of a jet trainer during ground runup hurled pieces of the airplane 90 feet and signaled the start of an investigation that ultimately involved the FBI, a university laboratory, factory technical representatives, and a host of special investigators.

Preliminary checks ruled out the possibility of sabotage and drew attention to the relatively new nickel-cadmium battery. But tests made on the airplane generator, voltage regulator, and battery showed that all had been functioning properly. In addition, the battery vent system was found to be unobstructed. After numerous attempts failed to duplicate the conditions which caused the explosion, the puzzled investigators became even more perplexed and the case took on all the aspects of a Sherlock Holmes mystery. But perseverance began to pay off as one fact after another started to unfold.

A nickel-cadmium battery mounted on a test stand was found to generate little or no gas during the initial charge. The charging current had dropped to practically zero with the 28.5 volt generator output and nothing had happened. Then, the generator output voltage was raised to 30.0 volts. Suddenly, balloons fitted over the caps of the cells began to expand, then bulge as the battery charged to the new voltage. The gas collected was found to consist of a highly explosive mixture of hydrogen and oxygen. The origin of the explosion had been discovered. But other questions remained unanswered: Since the voltage regulator had been functioning properly, what caused the formation of explosive gases? Once formed, why weren't these gases expelled through the open battery vents?

Additional tests showed that a cold voltage regulator tended to operate on the high side, in the range of 29.0 - 30.0 volts, until warmed up. At operating temperature, it stabilized at 28.5 volts. The explosion aboard the airplane occurred during the warmup period of the voltage regulator.

Although the battery vent system was found to be unobstructed, the gases accumulated because of the *downward* type vent installation. Hydrogen, being lighter than air, could not be discharged through this type of system without positive pressure. During ground runup, no positive pressure was available.

Finally, the ignition source was pinpointed as sparks from an operating inverter – and the mystery was solved. Since then, much has been learned about the peculiarities of nickel-cadmium batteries and the care they require. The following article was adapted from NAA SERVICE NEWS for publication in APPROACH magazine. It contains information which all maintenance personnel and aviators should know.

POWER PACKAGED TO GO!

The nickel-cadmium battery is a far superior battery for aircraft use than the more familiar lead-acid type. When properly used and maintained, the nickel-cadmium battery can outlast and outperform its lead-acid counterpart in many ways.

The nickel-cadmium battery can:

Deliver enough power for engine starts.

Maintain a steady voltage over 90 percent of its total discharge life.

Be charged in a short time.

Be recharged thousands of times without appreciable degradation.

Perform well at low temperatures.

In addition the nickel-cadmium battery is fully aerobatic, lightweight, does not normally exude corrosive fumes, is easy to maintain, and when necessary, individual cells can be replaced rather than discarding the whole unit.

As in other wet cell batteries, the cell is the fundamental unit of the nickel-cadmium battery. It consists of the positive and negative plate structure, separators, electrolyte, container, and cell vent. *There are, however, significant differences between the nickel-cadmium battery and the lead-acid battery. From a maintenance standpoint, these differences are extremely important.* Faulty care and servicing can cause needless destruction of nickel-cadmium batteries, and as a result flight safety can be jeopardized. The nickel-cadmium battery is also considerably more expensive than the lead battery, another reason proper care and handling techniques should be emphasized.

Basic Differences

The electrolyte in the nickel-cadmium battery is a solution of potassium hydroxide and distilled water. Chemically speaking, this is just about the exact opposite to the diluted sulphuric acid in the lead battery. This fact, in itself, is reason enough to dictate that the two batteries have separate storage and mainenance areas, since fumes from the lead battery would tend to contaminate the electrolyte in the nickel-cadmium battery. For this reason, *every possible precaution should be taken to prevent nickel-cadmium batteries from being touched by, exposed to, or breathed upon by acid—or anything containing acid.* This includes equipment such as hydrometers, syringes, and handtools, any of which could contaminate both types of batteries if used interchangeably.

The active materials in the nickel-cadmium bat-

tery are, obviously, nickel and cadmium, while lead and lead peroxide are generally used in the lead battery. The electrolyte in the nickel-cadmium battery does not chemically react with the plates as the electrolyte does in the lead battery. Consequently, the plates do not deteriorate, nor does the specific gravity of the electrolyte appreciably change. For this reason, *it is not possible to determine the charge state of a nickel-cadmium battery by checking the electrolyte with a hydrometer. Neither can the charge be determined by a voltage test because of the inherent characteristic that the voltage remains constant during 90 percent of the discharge cycle.*

How the Nickel-Cadmium Battery Works

Nickel-cadmium battery plates are constructed of nickel powder sintered to a nickel wire screen. The active materials, nickel-hydroxide on the positive plate and cadmium-hydroxide on the negative plate, are electrically bonded to the basic plate structure. The separators are constructed of plastic, nylon cloth, or a special type of cellophane, and assembled as a cell core with the plates.

The electrolyte, which is a 30 percent by weight solution of potassium hydroxide in distilled water, does not take an active part in the chemical reaction. It is used only to provide a path for the current flow. At 70°F, the specific gravity of the solution should remain within the range of 1.24 to 1.30.

Charging. When charging current is applied to the cell, the negative plates lose oxygen and become metallic cadmium. The nickel-oxide active material of the positive plates is brought to a higher state of oxidation. These changes continue in both sets of plates as long as the charging current is applied or both materials are completely converted; that is, all the oxygen is driven out of the cadmium oxide plates and only cadmium remains. The nickel-oxide plates pick up the oxygen to form nickel dioxide.

The cell emits gas toward the end of the charging process and during overcharging. The gas is caused by decomposition of the water component of the electrolyte into hydrogen at the negative plates and oxygen at the positive plates. The point of gassing is dependent upon the temperature and the charging voltage. A slight amount of gassing is necessary to completely charge the battery. Consequently, a certain amount of water will be lost.

Discharging. During discharge, the chemical action is reversed. The positive plates gradually lose oxygen while the negative plates simultaneously regain lost oxygen. During this process, the energy is released as electrical current through the discharge load. The rate at which the energy is converted is determined principally by the load resistance.

During the discharge process, the porous plates absorb the electrolyte to a point where it is not visible from top of the cells. When the battery is recharged the electrolyte level rises, attaining maximum level at full charge. For this reason, distilled or demineralized water *should be added only when the battery is fully charged.* This is the exact opposite of the lead-acid battery which must have full electrolyte before charging.

Another unusual characteristic of the nickel-cadmium battery is that when completely discharged, some cells will reach zero potential and charge in the reverse polarity. This action will adversely affect the battery, such that it will not retain a full capacity charge. As a result, it becomes the equivalent of a much smaller rated battery. The cure for this problem is to discharge the battery and short-circuit each cell to obtain a cell balance at zero potential. This process is known as "equalization." After equalization has been completed, the battery may be charged to its rated capacity.

Use But Don't Abuse

As stated earlier, the nickel-cadmium battery can outlast and outperform the lead-acid battery by a wide margin. This fact, however, should not be construed as meaning the nickel-cadmium battery provides an endless source of power. It has no magic rejuvenating capability and, like all aircraft batteries, it should be used only for its intended purpose – that of starting engines and supplying an alternate source of power in an emergency. *An external power source should always be applied to the aircraft when electrical power is required for troubleshooting and other maintenance functions.*

Servicing

Nickel-cadmium batteries should never be serviced in the aircraft. Because of their unique characteristics, as described in the preceding paragraphs, these batteries do not require as much attention as the lead batteries. Once installed in the aircraft, the main requirement is to keep the battery and

battery compartment clean and dry at all times. The battery electrolyte has a high affinity for carbon. Any amount of electrolyte that is expelled reacts with carbon dioxide to form white crystals of potassium carbonate. This substance is noncorrosive, nontoxic, and nonirritating, and can be wiped away with a clean damp cloth. The residue can be loosened with a stiff fiber brush.

Note: Formation of a potassium carbonate on a properly serviced battery installed in an aircraft may indicate the battery is overcharging. Voltage regulator adjustments may be required.

Caution: Never use a wire brush to clean the battery. Severe arcing may result. Do not attempt to clean the battery with solvents, acids, or any chemical solution. Make sure vent plugs are closed during cleaning.

Warning: The potassium hydroxide electrolyte in a nickel-cadmium battery is very corrosive. *Personnel should always wear rubber gloves, a rubber apron, and protective goggles when handling and servicing these batteries. If the electrolyte is spilled on the skin or clothing, the exposed area should be rinsed immediately with water or, if available, vinegar, lemon juice, or boric acid solution.*....

Before attempting to service a nickel-cadmium battery in the shop, maintenance personnel should become thoroughly familiar with the applicable procedures in Avionics Bulletin No. 25 and NavWeps 17-15BAD-1.

As recommended in NavWeps 17-15BAD-1, the first requirement for a service facility is to have *separate shops, isolating the nickel-cadmium batteries from the lead-acid batteries.* Separate areas are necessary to prevent destructive acid contamination. This same rule applies to the separating of servicing equipment, handtools, and gloves. The saving of just one nickel-cadmium battery from acid contamination will go a long way toward paying for the extra precautions.

In addition to keeping the nickel-cadmium batteries isolated, the following servicing tips will prolong battery life:

Never add electrolyte unless the battery is fully charged. Allow the fully charged battery to sit for at least 2 hours before adding electrolyte. The idle period is required because the charging operation drives the electrolyte out of the cell plates, and the electrolyte level does not stabilize for at least 2 hours.

Do not measure the voltage or the specific gravity of the electrolyte to determine the battery charge. Neither of these factors change appreciably during charge and discharge. The actual state of charge is difficult to determine but can be obtained by following the procedures listed in NavWeps 17-15BAD-1.

Add only clean distilled water to the battery. Additional potassium hydroxide should not be required.

Do not allow the battery to dry out.

Always charge and discharge batteries in a well ventilated area to prevent a collection of explosive gases.

Always check all electrical connections and terminal nuts for security and proper torque.

Do not paint or apply anticorrosive compound to the batteries.

When replacing cells, use only cells of the same part number, by the same manufacturer. Do not intermix cells in the same battery.

Keep vent caps in place at all times except when absolutely necessary to remove them. The electrolyte in open cells will absorb carbon dioxide from the air, which degrades the electrolyte.

Always use tools which are well insulated, to prevent arcing in case they are dropped on the cells.

Safety Is An Important Factor

There is one important safety hazard that should be emphasized. Overfilling the electrolyte in a nickel-cadmium battery when in a discharged or partially discharged state can lead to a chain reaction which would destroy the battery and possibly cause a fire or explosion. As stated earlier, when the nickel-cadmium battery is discharged, the electrolyte is absorbed in the plates. As a battery is charged, the electrolyte level rises. If electrolyte is added to a battery which is not fully charged, the stage is set for a possible catastrophic reaction.

During the first half-hour of flight, a tremendous amount of current is absorbed by a discharged battery. If the electrolyte level is too high, it will spew through the vent caps. Since the electrolyte contains potash, the cell vents may eventually become plugged. The resulting pressure buildup can rupture the cell case. The spilled electrolyte, which is highly conductive, may then cause intercell or cell-to-case short circuits. The heat generated by the short circuits may establish a chain reaction, causing other cells to spew electrolyte and emit gas. Introduction of a spray into the hydrogen-oxygen atmosphere may likely result in an explosion.

It is also worthy to mention that an overvoltage condition will also cause excessive gas liberation. It is very important that aircraft voltage regulation be checked periodically.

An account of evasion and survival in a Vietnam jungle

THIS MONTH we have the taped account of a brigade sergeant major who was a passenger in a helicopter that crashed in a jungle area of Vietnam. When it hit the ground, after flying through heavy foliage and trees, the helicopter spun around on its nose and came to rest against an embankment, pinning the pilot and another passenger in the wreckage. The sergeant major sustained lacerations, and one finger on his right hand was almost severed.

He was unable to free the two occupants from the wreckage and they urged him to go for help. When he found three mountain tribesmen and attempted to return to the crash site, he encountered enemy troops. The three tribesmen fled and he had to make his way back to friendly forces. During the 41 hours it required for him to reach an American base, the two occupants trapped in the aircraft were found by the enemy and shot.

We pick up his account immediately after the crash: "I grabbed the M-16 and one magazine of ammunition and ran up on the hill that was in the area. I did not see anyone and went back to the crash to see how the other two were. They urged me to get someone to help them out.

"This was a real thick jungle area. I knew we had passed over a village, which I assumed was approximately 1,000 meters to our rear. I headed back toward the village and had to cross a swampy

If you have a question about personal equipment or rescue and survival gear, write to Pearl, U.S. Army Board for Aviation Accident Research, Fort Rucker, Alabama, 36360

area or rice paddy. After I crossed this, I ran up on three Montagnards carrying baskets. I forced them to put their baskets down and come with me back toward the helicopter. When we reached the swampy area, I saw about seven figures on the other side. Three of these had weapons and I assumed they were VC. The Montagnards began to chatter to each other, pointed toward the people I had seen, and ran. I could not hold them and I didn't want to shoot them."

"Why did you think they were VC?"

"I saw their uniforms. They were moving back and forth and three had weapons. The other four were carrying packs.

"I circled to the right and tried to get around behind so I could come back up by the crash. As I circled, I saw the bushes moving and knew they were in front of me. I couldn't cross the swampy area because it was 15-20 meters across and this would have put me in the open."

"Were they following you?"

"They were circling with me. I don't know if all seven were or not, but some were. Undoubtedly, they saw the helicopter go down, so when I got on the other side and saw I could not get back, I figured the best thing to do was go back to a road which I had seen. At the time, I thought this road was to the west, but I have learned since that it runs from east to west. So, instead of going to the road, I was traveling parallel to it.

"I maintained this direction until dark. I passed over a stream up on the side of a hill and saw a big opening to my right. I figured that if I stayed by this opening until morning, and it was a clear day, I could get out in the opening, show myself, and get picked up."

"What time of day was this?"

"It was approximately 1900, or a little after. I had looked at my watch and I knew that darkness would come real fast, so I crawled into the bushes on my hands and knees and got into a real thick spot beside a small tree. I wanted to make sure that if they came after me that night, they would have to do the same thing and make a lot of noise.

"I chose a small tree because big trees usually have clearings around them.

"It began to rain about 2100 and rained off and on all night. At one time, I'm sure a large snake crawled by. I took a stick and pushed at it and it began to hiss. I thought it was a python. I could not shoot it or try to fight it and make a noise without giving my location away."

"Did the mosquitos bother you?"

"Yes. I took off my undershirt and put it over

"I circled to the right and tried to get around behind so I could come back up by the crash . . . as I circled, I saw the bushes moving and knew they were in front of me."

". . . I stripped down to my waist so the aircraft crews could see my white skin. A helicopter came over . . . made a couple of rounds over my head nearby, but the pilot didn't see me."

my head to keep the mosquitos off and also wrapped my hands in it. A finger on my right hand was pretty badly cut, so I tore my shirt and put a piece of it around my finger to wrap it up.

"The next morning, it rained and was misty and cloudly. I knew no aircraft would be up at that time and I was afraid to stay as close as I was to the crash, knowing the enemy had seen and probably followed me."

"About how far were you from the crash site?"

"Approximately 2,000 meters, through very rough country. I crawled quite a bit, bruising my knees, and went through the underbrush to the top of the hill."

"What were your intentions?"

"To get up where I could see. I didn't want to get into a big opening, or on a large hill, because I didn't want to be seen by the enemy and they can usually be found on the large hills. This was a small hill and I knew there was a village to my right which I had gone toward to get the Montagnards. The weather was still very bad. It was foggy and continued to rain.

"I hit a tank trail which was also part of a Montagnard path. One tank track was in the path and the other out."

"Was it an old tank trail?"

"It was an old trail and it was going in what I thought was the right direction for me, to the west. I saw very few footprints and only one bicycle track, but I knew it would lead to a village. While traveling along this trail, I spotted three VC with weapons. They were off to my right front across a small rice paddy. I don't think they saw me at that time, but I turned and started southeast. I went through a thicket, found a clearing, and went down the right side of the clearing until I saw it open up into elephant grass which was too tall to get through. I turned back to my right and started west.

"I continued west down to a small river and crossed it. There was a small rise on the other side. I went up the rise and when I looked back, checking to my right, I again saw three VC. I don't know if they were the same ones."

"How far had you traveled since you saw the original ones?"

"Approximately 1,000-1,500 meters. I went up the hill and found a fast moving stream on the other side. It was only about 8-9 feet wide, but I couldn't jump it. I knew that if I got into it I would be washed down and lose my weapons. I was fairly weak as I hadn't had any food since noon of the previous day."

"Did you still have your weapon sling?"

"No. After I saw the seven VC the night before and crawled into the bushes, I took it off because it made too much noise.

"When I saw this fast moving stream, I knew I had to go either up or down it to find the rice paddies where I could cross. I chose to go west along the stream and continued in that direction until I came to the rice paddies. I went up to where the rice paddies were the narrowest and crossed there.

"I went up the side of this mountain and came to a clearing. It took me about 2 hours to climb the mountain. When I got to the top and came to the clearing, I checked it out real carefully, walking all the way around the clearing and checking all the wooded area. Then I went to the center of the clearing where there was some elephant grass, hid myself, and looked at my watch. I was still traveling west, the way I wanted to go, and I knew there were aircraft ahead of me. I had heard helicopters that morning, but could see none. I stood on the hill and stripped down to my waist so the aircraft crews would be able to recognize me easily, because of my white skin. I propped my weapon against the side of a tree and checked my ammunition. I then unloaded the weapon, shook it down, and put it back together.

"A helicopter came over to the south and I got out in the clearing and waved my jacket. They apparently didn't see me as it passed over. I went back and a fixed wing aircraft flew fairly close over me. I again waved, but I wasn't seen. I was there for about an hour from the time I checked the area out. Another aircraft came over and I began waving at it and it made a couple of rounds over my head nearby, but the pilot didn't see me.

"I went to my rear and saw the VC again."

"How far away were they?"

"At least 500-700 meters."

"Were they above you?"

"They were slightly below me, on a hill. They were not at the bottom of the hill. Had they been at the bottom, they could not have seen me because of the curve of the mountain.

"I knew that I had been seen again and I went back into the woods, found another tank trail, and went up it until I came to a real nice Montagnard trail. This trail was beat real well and the underbrush and weeds were cut down on both sides, typical of the trails around Montagnard villages. I went down this trail until I saw what I thought was a stream and eased down to it real slow. It was not a stream, but a rice paddy about 20 meters or so across. I sat there for about 10 minutes, looking across to make sure no one was over there. I knew

someone was behind me, but I wanted to make sure my front was clear.

"As I left, I crossed over a swift running stream of clear water and filled my canteen. The water was clear and sweet, so I drank it.

"I went across the rice paddy up the other side. It took me approximately 20 minutes to get to the top of the hill and it was approximately noon. I did not go to the Montagnard village. I saw someone, so I skirted to the south. There was this big open area and I found some barbed wire where some Americans had been. By the shell casings, I knew it had to be an artillery outfit. When I got up close to the little road where they had resupplied, I figured it had been an armored artillery outfit because of the tracks in the ground.

"When I got to the road, I stayed by some bushes so I wouldn't be seen. I didn't want the villagers to see me. I stayed 300-500 meters away from the village on the south side. It began to rain again a little after 1300, but the sun was still out and it was nice weather. Again, aircraft flew all over me and I waved my jacket to all of them, but apparently I was not seen.

"I decided I would just walk to a town by heading northwest along the road."

"Had you eaten anything yet?"

"No. The crash was Friday afternoon and this was Saturday afternoon."

"Did you have any ill effects from the water you drank?"

"No. I started northwest on this road beyond the village, walking to the west of the village, off the road to keep anyone from seeing me. But I ran into a young boy with a herd of water buffalo. He saw me, but I didn't think anything of it and went on down the road until I found that the road ran out the other side of the village. I turned around and went back.

"As I was walking back, an Air Force aircraft of a new type, with one motor in front and one in back, was flying right up the road from west to east. I quickly dropped my weapon, pulled off my jacket, and waved as it approached me. The pilot cut his motor like he recognized me or saw me, but he didn't tip his wings. He went over me, gunned the thing, and took off again.

"I put my clothes back on and started up the road. I went beyond the road back to where I had been all morning. The weather was nice and it was not raining. I could look up the road, maybe 2-3 miles at a time. I could see a turn at the top of the hill and a big tree. While I was standing there, trying to decide whether to go up the road or stay off the road, I saw a pair of slicks go across by the big tree. I told myself I would take a break after I got to that big tree. It took me about 30-40 minutes. When I got there, I could still see the bend at the top of the hill, another mile or so away.

"I headed for the top of the hill and met a Montagnard kid. He was dressed more like a Vietnamese, but I could see he was Montagnard by his dark color. He was on a bicycle. He stopped and spoke a few words of English, then began howling. He didn't know if I was going to attack him or what. He tried to explain to me that he was going to see a brother and that he taught school. He could speak Montagnard, Vietnamese, and a few words of English. He could also speak a little French, so I could make out what he was trying to tell me.

"I tried to get him to ride me on his bicycle, but he couldn't because he was too small and his right leg was crippled. I said OK and went on up the road. He rode down the road about 50 meters, then turned around and came back. He said four words: 'I go with you.'

"I put my belt, canteen, and pistol on the back of his bike and we walked along for about an hour. We got to the top of the hill and around a little curve. I was very tired by this time, approximately 1600. I put my weapon on the back of his bike also. Before doing this, I unloaded the round in the chamber and just left it in the magazine, in case the kid was a bad guy, so he couldn't jump me quick with a loaded weapon. I was pretty weak and I had lost blood. I'm in my forties and I can't keep going like I used to. I was still moving along and we went on up the road until approximately 1800, when we could see what he said was his village.

"I was a little skeptical about going in. I took the weapon off the bike so that I would have it in my hand when I went in. We left the road, crossed a little foot bridge, then went through a gate. I noticed barbed wire all around the village and some dug-in emplacements they could fire from.

"Inside, I found the kid had a couple of brothers. The tribesmen all had weapons and were defending the village. At night, they would go out, but not all would leave. Some were always left behind. After we were inside, they went out and got a man who spoke French, because I had told them I spoke French. I don't speak it real well. This man came and we talked together and I managed to explain my problem and tell him I was hungry.

"He told me that all they had was Montagnard

food and that it would be rice. The little kid that came with me talked to him and he said that he could buy some chickens if I had some money. I happened to have 500 P on me, approximately $4.50. They took this and went and bought two chickens. Pretty expensive chickens!

"When they brought the chickens, the father came home and the people who had been working in the fields came back. It would soon be dark and I knew I had to make up my mind whether to stay there or not. I was still talking to this man who spoke French while they were getting the chickens ready to cook. He convinced me there was no reason why I should not stay in the village. He said that if the VC came, we would all fight. He told me they had something like 30 defense troops, armed with carbines and M-1s, in the village.

"I couldn't eat very much. I was too pooped. I think I drank two canteens of water in about an hour and a half. It was about 2000 when we got through eating and I told the man who could speak French that I wanted to go to sleep. At this point, another man came in and tried to explain to me who he was. In French, he got it across that he was more or less commandant of the military force. He was not the village chief, but he was high up in the defense of the village. He told the French speaking Montagnard that he wanted to go get some wine. I didn't care for any, but I did not want to insult him, so I said, 'Fine, go get some wine.'

"By this time, it was dark and four or five candles had been lit in the sleeping quarters of the house. The whole village came to see. Those that weren't inside were standing outside looking in. All were there, old and young, clothed or otherwise. Through the interpreter, I thanked them for coming to see me.

"What this Montagnard wine is, they have it in a crock. It is fermented rice and I don't know what else. They dump water in it because the bottom of this thing is just like whiskey, real alcohol. They dump about a quart or so of water in it and shake it a little. There is a little platform built down 2 or 3 inches below the surface. You are supposed to drink from the surface to the platform. When the platform shows, you stop. Then they pour more water and the next guy drinks.

"While we were drinking, a youngster came in who was not a Montagnard, at least I didn't think he was. I asked who he was and they said he was a special forces man from the Army, stationed with them. They didn't say whether he was Montagnard or Vietnamese, but he was a corporal in the special forces of the Vietnamese Army. He showed me his card and we sat and drank until 2200. I finally got rid of the whole bunch and went to sleep.

"The Montagnard kid who had helped me and his brother slept on one side of me and the special forces corporal slept on the other. All of us slept on the floor. There were not many flies and no mosquitos. I asked why this was, but they couldn't explain it.

"I got up the next morning about 0645. The boys told me it was time to start for town. Three of them went with me. I put my belt on the kid's bicycle and, after an hour of walking, I gave my weapon to one of the guys to carry. They weren't carrying weapons, but they said it was safe. I was still weak, even though I had eaten some chicken the night before."

"Did you have any breakfast?"

"No. They don't eat breakfast. They just eat a big bunch of rice at night and again at about 1000 or 1100 during the day. After about an hour or so up the road, I did drink some water.

"A little after 1000, I could see the big antennas here at the base and I knew I was going in the right direction. We were still 8-10 miles away. I saw a jeep coming up the road below us and we kept walking toward it. Many aircraft flew over us and I was still waving my jacket at them, carrying it over my shoulder, naked from the waist up. But no one saw me.

"We got down the mountain and the jeep finally reached us. There was a Vietnamese lieutenant and sergeant in it. The lieutenant spoke fairly good English and I told him about my problem. He told me to get in and he'd carry me right on in."

"Do you have any suggestions for anyone who finds himself in the same predicament in areas such as you were in?"

"I think it's a good idea to travel like I did. Several times, I crawled on my hands and knees for 100-200 meters through real thick underbrush. When I'd get to an open area on the other side, I'd sit for a few minutes and look over the area before I tried to cross it. When I crossed, I would skirt around one side. This is taking a chance on meeting someone on that side, but anyone on the other side would be 200-300 meters away. They'd have a harder time hitting you at that range.

"When I saw the enemy, I usually cut at right angles for a few hundred meters, then I would take off in my original direction again. If they started following me, I would always go through something thick to make it hard for them to follow. Then I would hit an open trail, as open as possible, where I could travel fast in order to get away from them without their having a chance to circle."

. . . the type missions currently employed by Army aviation units in combat have placed an increasing demand on pilots to devote their attention outside the cockpit . . .

Lieutenant Colonel Clement A. Wyllie
Chief, Engineering Branch, USABAAR

THE PURPOSE of this article is to acquaint readers with a new generation audio warning device known as to Voice Warning System (VWS) and the promote its application to tactical Army aircraft as an accident prevention tool.

Tactical, administrative, and training missions require the full attention of pilots to flying their aircraft. High speed nap-of-the-earth missions of the type currently employed by Army aviation units in combat have placed an increasing demand on pilots to devote their attention outside the cockpit. The increasing complexity of modern aircraft also requires that pilots be provided accurate and timely information regarding hazardous conditions which may adversely affect mission accomplishment. These requirements leave pilots little time to monitor visual indicators on instrument panels to detect in-flight malfunctions and take appropriate corrective action.

Army aircraft are presently equipped with a limited number of caution and warning light indicators which provide visual indications whenever malfunctions or unsafe conditions exist. These lights are activated automatically and remain lit until proper corrective action has been taken. During many phases of flight, this display is discernible. However, during certain other phases, the pilot's attention is necessarily outside the cockpit, or areas of the displayed visual warning system. When time and conditions permit, the pilot may be required to refer to a checklist to correct unsafe conditions that have been sensed. In many cases, time is a critical factor and the pilot must rely on memory and training response to take appropriate corrective actions.

Warnings and cautions currently presented by visual display require that the pilot orient his eyes toward the display to perceive and interpret a warning. After he interprets the display, he must then determine what action to take to correct the condition.

Human factors studies[1] have shown that visual displays provide relatively low pilot response time only with proper eye orientation, when single events occur, and when mental stress is low. Whenever the number of faults increases during a given period of time, an increase in reponse time is apparent. Visual loads imposed by mission requirements interfere with proper eye orientation when a visual warning is displayed.

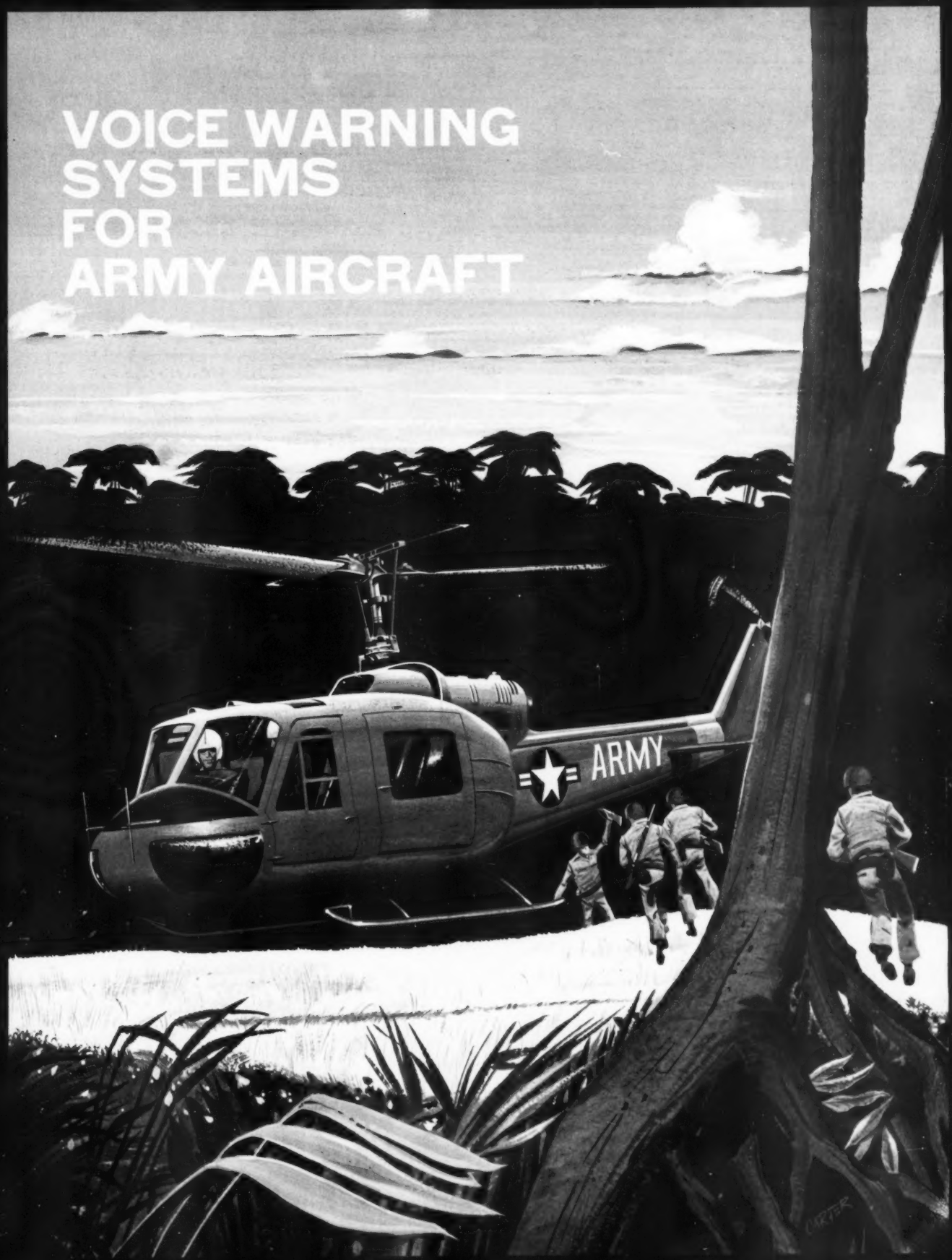
Army aircraft accident experience [10, 12] indicates a definite need for some type of audio warning device which will point out to pilots, when their orientation is outside the cockpit, the existing malfunction and, at the same time, indicate the corrective action required. One such device in existence is the Voice Warning System (VWS). A human voice warning is transmitted over the pilots' earphones, directing attention to a specific hazard and specifying remedial action. When two or more malfunctions occur at the same time, the device transmits each warning according to a predetermined priority sequence.

Equipment configuration: A typical voice warning system[6] consists of three components – a voice signal reproducer converter (VSRC), a signal adapter unit, and a control panel. It senses approximately 50 input faults and programs them into 20 output messages. Total system weight is approximately 10 pounds, with cabling.

The VSRC is the principal unit of the system, containing tape transport, an audio-amplifier, and associated message channel circuitry. It monitors input fault sensors on the aircraft and combines them into prerecorded output messages. These output messages are connected directly to the pilots' earphones. The VSRC unit has a predetermined number of message channels, depending upon the requirements of the aircraft in which it is installed.

Each channel monitors one or more fault sensors on the aircraft and provides a specific message applicable to the activating fault or faults. Each channel has a relative order of importance with every other channel. Therefore, if multiple faults occur simultaneously, only the message of highest priority will be played. Once a channel is activated, the message is continuously played until:

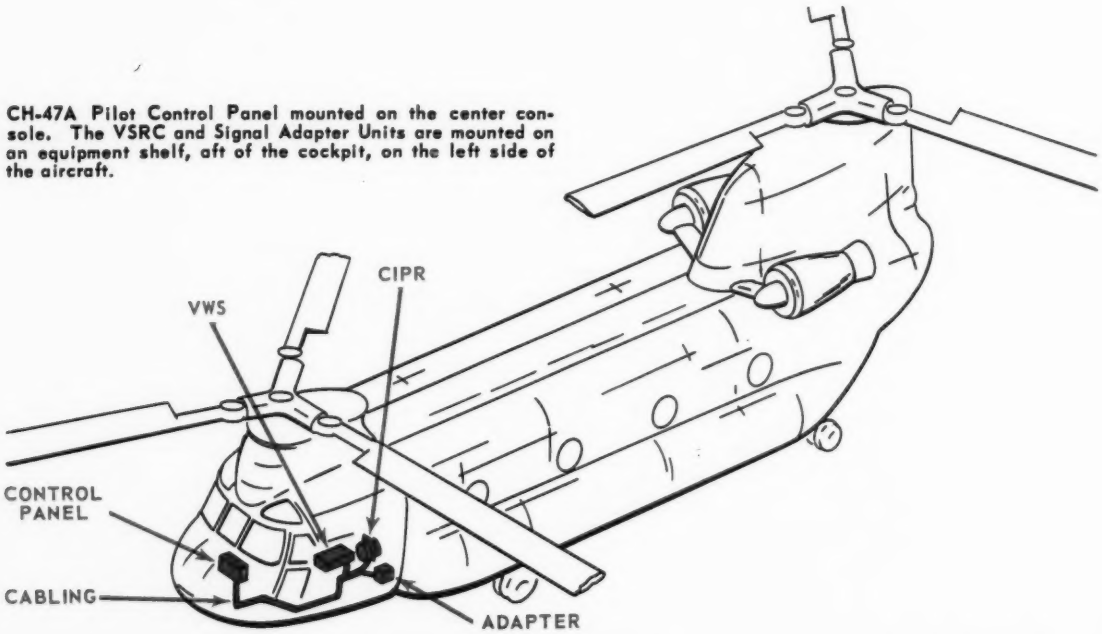
VOICE WARNING SYSTEMS FOR ARMY AIRCRAFT



VOICE WARNING SYSTEM

1. The fault is corrected by the pilot.
2. A fault occurs on a channel of higher priority.
3. The message is silenced by the pilot's override circuit. (Successive operation of the override switch permits monitoring of all messages for which inputs are present.)

The signal adapter unit receives



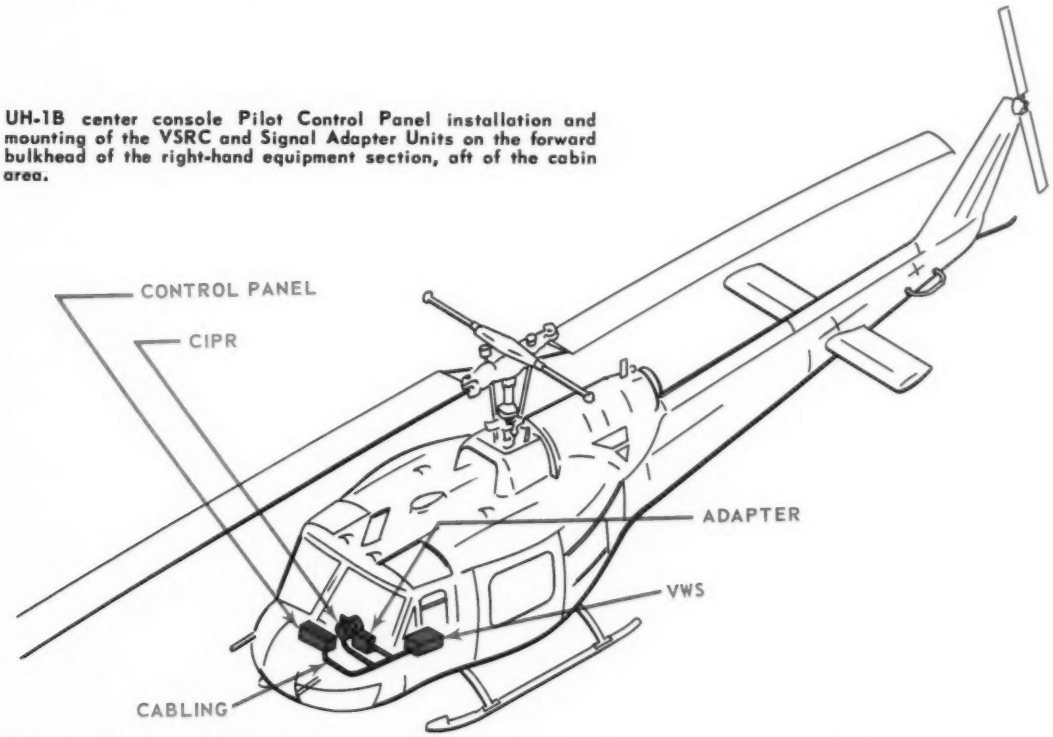
CH-47A Pilot Control Panel mounted on the center console. The VSRC and Signal Adapter Units are mounted on an equipment shelf, aft of the cockpit, on the left side of the aircraft.

INPUT FAULT	OUTPUT MESSAGE	INPUT FAULT	OUTPUT MESSAGE
Left engine fire Right engine fire	Fire warning	Xmsn oil pressure low	Xmsn oil pressure low
		Xmsn oil temperature high	Xmsn oil temp high
Left EGT above ..... °C	Left EGT high	#1 hydraulic boost off #2 hydraulic boost off	Hydraulic pressure low
Right EGT above ..... °C	Right EGT high		
Left engine torque Right engine torque	Torque differential high	Landing checklist	Lndg checklist (30 sec)
		Takeoff checklist	Takeoff checklist (30 sec)
Left engine N1 rpm below 66%	N1 low - left engine	Left fuel pressure low Right fuel pressure low	Fuel pressure low
Rt engine N1 rpm below 66%	N1 low - right engine		
Left EGT above ..... °C Right EGT above ..... °C	EGT abnormal	Left fuel quantity low Right fuel quantity low	Fuel quantity low
Rotor rpm above 236 rpm Rotor rpm below 220 rpm	Rotor rpm abnormal	#1 rectifier off #2 rectifier off Rotor brake on Park brake on Heater hot AC external power on DC external power on #1 generator off #2 generator off	Check caution panel
Combining xmsn chips Forward xmsn chips Aft xmsn chips	Transmission chips		
Left engine xmsn chips	Chips - left engine xmsn		
Right engine xmsn chips	Chips - right engine xmsn		
#1 engine oil low #2 engine oil low	Engine oil - low		

analog signals from existing aircraft sensors and converts them into 28 volts d.c. for the VSRC unit. Parameters such as exhaust gas temperature, rotor rpm, fuel pressure, etc., are usually restricted to panel gauge displays and must be processed for VSRC input. This unit may not be required on all aircraft, depending upon the particular electrical system involved.

The pilot control panel contains the necessary controls for operation of the system. It permits the pilot to perform these functions: power (on/off), override, test.

UH-1B center console Pilot Control Panel installation and mounting of the VSRC and Signal Adapter Units on the forward bulkhead of the right-hand equipment section, aft of the cabin area.



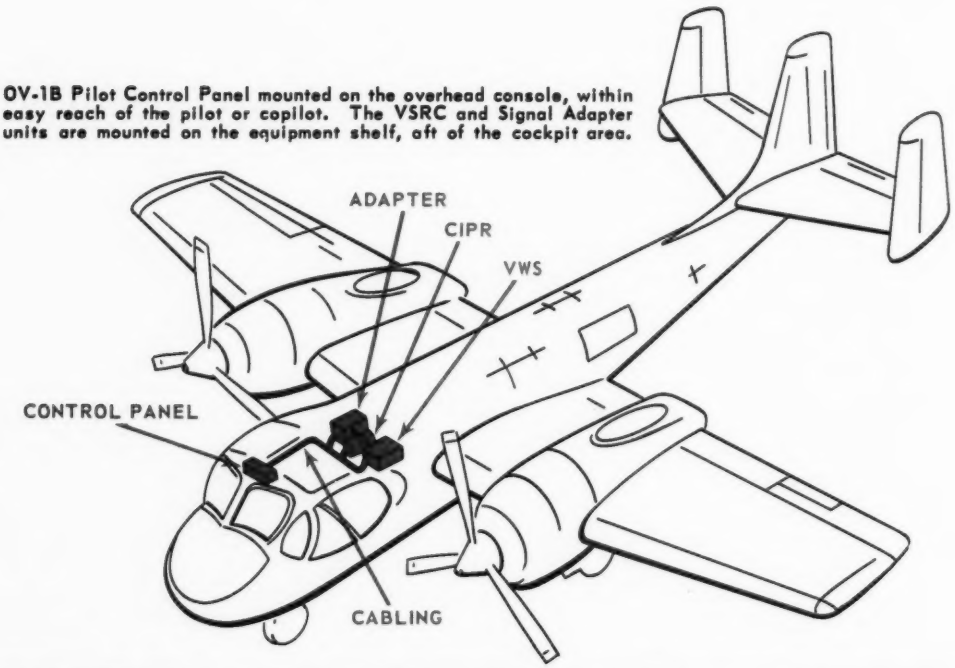
INPUT FAULT	OUTPUT MESSAGE	INPUT FAULT	OUTPUT MESSAGE
Engine fire	Fire warning	Right fuel boost pump flow	Fuel pump failure
Engine rpm low (N2) Below 6100 rpm	N2 low, check N1	Auxiliary fuel low	Auxiliary fuel low
EGT above 760°C	EGT high	Left fuel boost pump flow Right fuel boost pump flow 20 minutes fuel remaining	5 minutes fuel remaining
Rotor rpm above 339 rpm Rotor rpm below 295 rpm	Rotor rpm abnormal	20 minutes fuel remaining	20 minutes fuel remaining
EGT above 615°C	EGT abnormal	Fuel filter clogged	Clogged fuel filter
Transmission chip detector	Transmission chips	Landing checklist	Lndg checklist (30 sec)
Engine oil pressure low	Engine oil pressure low	Takeoff checklist	Takeoff checklist (30 sec)
Xmsn oil pressure low	Xmsn oil pressure low	Governor in emer position	Governor in emer position
Xmsn oil temperature high	Transmission oil hot	Spare	Spare channel No. 19
#1 hydraulic pressure low #2 hydraulic pressure low	Hydraulic pressure low	Inst inverter inoperative DC generator failure External power on	Check caution panel
Engine fuel pump pressure Left fuel boost pump flow	Fuel pump failure		

VOICE WARNING SYSTEM

Adaptation: This equipment is compatible for installation in Army aircraft. The criteria for equipment location should be based upon available space, accessibility, and minimum cable length. The illustrations represent suggestions for installation in typical Army aircraft.

Message Structuring: Message priority and content should be

OV-1B Pilot Control Panel mounted on the overhead console, within easy reach of the pilot or copilot. The VSRC and Signal Adapter units are mounted on the equipment shelf, aft of the cockpit area.



INPUT FAULT	OUTPUT MESSAGE
#1 engine fire #2 engine fire	Fire warning
#1 EGT above 760°C	Left EGT high
#2 EGT above 760°C	Right EGT high
Wheels not at down position	Wheels not down
#1 gas prodr rpm (N1) below 60%	N1 low, left engine
#2 gas prodr rpm (N1) below 60%	N1 low, right engine
#1 EGT above 615°C #2 EGT above 615°C	EGT abnormal
#1 engine chip detector #2 engine chip detector	Engine chips
Lndg gear positional lock	Lndg gear unsafe (w/delay)
Autofeather on during lndg: Autofeather relay coil on Autofeather relay wiper on Wheels down	Autofeather is armed
Autofeather off for takeoff: Autofeather relay wiper off Shrink rod shrunk	Autofeather not armed

INPUT FAULT	OUTPUT MESSAGE
Fuel pump #1 diff press high Fuel pump #2 diff press high	Fuel pressure high
Fwd boost pump press low Aft boost pump press low	Boost pump failure
Fuel low control unit	Main fuel quantity low
Right fuel strainer press Left fuel strainer press	Fuel strainer contaminated
Landing checklist	Lndg checklist (30 sec)
Takeoff checklist	Takeoff checklist (30 sec)
Fuel control #1 Fuel control #2	Emergency fuel on
Engine #1 icing Engine #2 icing	Engine icing
Rt drop tank transfer press L drop tank transfer press Generator #1 Generator #2 Instrument (inverter) power	Check caution panel

structured individually for each type aircraft in which the voice warning system is installed. Responsible agencies must determine the critical areas to be monitored for input faults and priority established. The relative priority of many faults will be apparent (i.e., "Engine Failure" should have priority over "20 Minutes Fuel Remaining"). However, others will be judgment determinations. Examples of message structuring for three Army aircraft used to test the AN/ASH-19 Voice Warning System at Fort Rucker, Ala.,[9] accompany the illustrations.

Experience: In 1948, the Boeing Company[8] patented the basic multiple-channel voice warning system. Since it was invented with government funds, a free license accrues to manufacturers who use the principle in government applications. Shortly after the invention, U. S. Air Force and U. S. Navy research groups conducted studies to determine aircraft application. Because of the lack of design maturity, little evolved until 1961, when the Air Force issued an engineering change proposal for retrofit of all B-58 Hustler aircraft. The system has been credited with saving aircraft on numerous occasions.

In June 1963, Headquarters, Tactical Air Command, USAF, Langley AFB, Va., completed an operational test and evaluation of a voice warning system[4] manufactured by Astropower, Inc., Costa Mesa, Calif. The purpose of this test was to determine the degree that a VWS would enhance the pilot's ability to cope with system malfunctions or unsafe operating conditions. Results of this test indicated a significant improvement in pilot reaction time, especially during periods of heavy workload and stress. In general, the system produced a 93.3 percent improvement in average pilot response time.

The U. S. Army conducted a military potential test of the Nortronics AN/ASH-19 Voice Warning System during the period August 1965 to January 1966 at Fort Rucker, Ala. The system was installed in OV-1, CH-47, and UH-1 aircraft and operationally tested. It was concluded[9] that the system increased flight safety of the aircrew and improved the combat effectiveness of the aircraft. Also, the voice warning system is a valuable supplement to the warning system currently used in complex modern aircraft.

Specific examples of types of aircraft accidents which could have been prevented by a voice warning system are:

Automatic Fuel Control Failures: During a 1-year period[3], five UH-1 helicopters were involved in major accidents due to automatic fuel control failure. A failure of this control requires immediate response by the pilot to switch into the manual mode to regain control of the engine. The pilots involved in these accidents were unable to detect the failures and take appropriate action in time to prevent the accidents. Their orientation was outside the cockpit, due to low level, high speed, nap-of-the-earth operational requirements. These five accidents resulted in 12 personnel injuries and $914,507 in damaged aircraft, training losses, and reduced mission capability.

Overheating of Transmissions: Several CH-47 helicopters[3] have been lost because the pilots were not aware of inflight transmission malfunctions. The present system requires one manual and two visual interpretations by the pilot to determine if one of several transmissions has overheated or has low oil pressure. A voice warning system would immediately inform the pilot of existing problems and instruct him to land immediately.

Conclusion: Based on accident experience, aircraft complexity, operational requirements, and comprehensive military testing, it is concluded that voice warning systems will increase flight safety of the aircrew and improve combat effectiveness of the aircraft in which installed. It will enhance pilot ability to cope with airborne emergencies expeditiously and in a logical sequence. It will reduce pilot response time and call attention to the presence of malfunctions which might otherwise go unnoticed for long periods of time, or until they result in serious problems. It would be a valuable supplement to visual warning systems currently used, or facilitate elimination where redundancy is not required.

REFERENCES

1. Bate, Almon J. and Charles Bates, Jr., *A Comparison of Cockpit Warning Systems*, Fort Rucker, Ala., 1966.
2. Headquarters, U. S. Army Aviation Materiel Command, *Letter SMOSMEGS, Subject: Safety of Flight*, October 15, 1965.
3. Headquarters, 11th Air Assault Division, *Letter AJVAV-CO, Subject: Voice Warning Systems in Army Aircraft.*
4. Headquarters, Tactical Air Command, USAF, *Operational Test and Evaluation of Verbal Warning Systems*, TAC-TR-62-20, Langley AFB, Va., June 1963.
5. *Nortronics Fault Location and Warning System* (FLAWS), NORT 66-82, June 1966.
6. *Nortronics Voice Warning System*, NORT 67-86, May 1967.
7. Northrop Nortronics, *Reliability Assurance Test, Contract No. N600(19) 63669*, August 1966.
8. Radar Relay Division of Teledyne, Inc., *Report on Fault Location and Audio Warning System (FLAWS)*, September 1967.
9. Smith, Earl B., *Military Potential Test of the AN/ASH-19, Voice Warning System*, Fort Rucker, Ala., March 31, 1966.
10. Tolson, John J., Brigadier General, *Letter AV-OTS-9, Subject: Voice Warning Systems in Army Aircraft*, March 31, 1964.
11. U. S. Naval Test Center, *Technical Report ST 31-22R-63, Evaluation of Astropower, Auditory Information Display on VA-3B Airplane*, June 1963.
12. Wyllie, Clement A., Lt Col, USA-BAAR, *Memorandum, Subject: Voice Warning Systems*, Fort Rucker, Ala., February 1966.

Mexican Newspaper

Continued from page 33

IT IS 4:35. We arrive at a town which is one of the most affected.

The helicopter is surrounded by some 500 persons. When they begin to lower the bags with provisions, men of rough appearance and bare chested have received orders to form a chain for passing along the provisions. But there are some who, as soon as they receive a bag, turn and run with it.

They want it for themselves; for their families.

Garza Gonzalez runs after them. There is scuffling.

Some men positively refuse to give back the provisions: "I'll not give it to you," they say to Garza Gonzalez. "I need it."

Later a committee is chosen among the strongest men. It is made up of five. "This food," he tells them, "is for everyone. It must be distributed equally, giving preference to the children, women and elderly. I make you responsible for any ill use to which it might be put. You are responsible to the President of the Republic."

BEFORE FORMING the committee, Garza had seen a man with a pistol. He was a policeman. He asked him if he would take into consideration being on the committee, but the man refused. "No, sir; I will not be responsible. Myself, I'm going to throw down everything from above."

After realizing several similar situations filled with dramatic incidents, funny or touching, and of hard work and rough going between the water and the mud in order to determine if there are epidemic centers or grave illness, the helicopter pilot, Capt. Fredrick Schenker and his co-pilots, Captains Harry Assenberg and Alvey Martz, discover a house embedded on the top of a little hill. It is the only house there is. No one is around.

Through a foreboding of Garza Gonzalez, the captain of the flight is ordered to descend. We land some 500 meters from the house, and the doctor, Garza, and the representatives of El Sol de Mexico go toward the building. In the door there are women who go back in.

The doctor asks them why they do this. He goes in the house and discovers several sick children. All have diarrhea and fever.

THE WOMEN beg us not to take away their sons. And the doctor, with kindness and pathetic solicitude, explains to them that no one is going to take their sons. "We have come to help you; not to cause more problems," he tells them.

Later he sends to the helicopter for medicines and shows the women how to use them. Also he leaves them canned food and milk, and gives them advice so that their sons might gain prompt relief.

The light of the sun is dying. The time has passed without being noticed. Those who go on board the helicopter are distributing food and medicine. And they themselves are hungry and sick. All of us have headaches because of the activity, the stress, and the devilish and deafening noise of the helicopter.

Inside the helicopter all is dark. Lieutenant Colonel Cunha has given orders for all the crew (11 men) and the volunteers on board to watch over the injured.

NOW, WITH the night almost grown dark, some men, bare from the waist up, are discovered dragging a raft. The water reaches to their chests, and on the raft are some children and women, as well as clothing and provisions.

In the helicopter, now, no provisions remain. Everything has been distributed. There remains only one small little box with medicines.

The helicopter remains suspended a half meter from the water. Without giving it a moment's thought, Garza Gonzalez grasps a pipe in the top of the helicopter and stretches out his feet. The North American soldiers try to restrain him but only manage to remove the boots of the "tyrant." The northerner, with courage, rushes through the water to help the men coming with the raft. Other volunteers are somewhat afraid for a moment, but follow Garza Gonzalez.

The ones with the raft have been detained at a distance. The wind from the blades of the helicopter will not let them come near, but Garza Gonzalez reaches them.

MINUTES PASS. It is now dark. With great difficulty, Garza Gonzalez returns (he does not have even one cable to help him in the midst of the wind and the water) and says that those on the raft do not want to leave there. Their sons, their wives and brothers are over in a school situated on a little hill. They have come to where their homes had been to hunt in the muddy water and find their blankets. They have no food.

There is panic on the helicopter. There is nothing to leave them, except the very small box of medicines.

Data is taken on the position and it is reported by radio to another unit of the Mexican Army that flies nearby. But, unfortunately, the helicopter of the FAM also has exhausted its supply of the provisions which it had.

"Tomorrow at dawn we will bring them food," Garza Gonzalez told them.

At 2120 hours the 619122 U. S. Army lands at the Reynosa airport. Garza Gonzalez is still with cold, with drenched clothing. The rest are exhausted. We bring on board several injured, among them five children, their mother and a woman about to give birth.

WHAT'S YOUR ATTITUDE?

LOSER

- "I'll get it when my number is up."
- "It can't happen to me."
- "It's the law of averages."
- "An accident is an act of God."
- "Danger is the price of progress."
- "I'm tough—I don't bruise easily."
- "Safety is 'sissy stuff.'"

"The aviator inspired with mission accomplishment is a true professional and deserves the highest praise. The aviator imbued with mission accomplishment at any cost is an unprofessional whose judgment is to be challenged. This amateur must either turn professional or get out of the flying business before he negates the efforts of those getting the job done."

MAJOR GENERAL GEORGE P. SENEFF, JR.

Adapted from 4th Army AVIATION SAFETY LETTER by Colonel Curtis L. Hankins

THE GREEN BERETS— The opening scenes of John Wayne's "The Green Berets" is filmed at the U. S. Army Aviation School, Fort Rucker, Ala., as UH-1 helicopters fly by. In attendance are David Janssen (right) and Craig Jue (next to Janssen). The two co-star with Wayne—Janssen playing the role of a newspaperman and Craig a Vietnamese orphan

DURING THE PAST few months the occasional cry of "Lights, cameras, action" has been mingled with the familiar cadence of marching troops and whirling rotor blades at Fort Benning, Fort Rucker, and Hurlburt Air Force Base.

John Wayne and a host of Hollywood actors for more than six months were filming Wayne's new picture "The Green Berets" on location at these installations. A great deal of the filming includes actual Army personnel and U. S. Army aircraft.

As the title implies, the film features the Army's Special Forces. However, after Wayne visited Vietnam, he realized the immense role aviation is playing in action there and has given it almost as much emphasis as the berets.

Filming actually began in Southeast Asia in April 1967, but when aviation's importance was noted, Wayne decided a location where aircraft were available would have to be selected. Fort Benning finally was chosen, both for its topographical similarity to Vietnam and the aircraft available. Other filming was done at Fort Rucker and Hurlburt.

Also starring with Wayne are David Janssen, Bruce Cabot, and Craig Jue who plays a Vietnamese orphan.

Wayne, as actor-producer, plays COL Mike Kirby who has served in Vietnam and wants to return as commander of a Special Forces A team.

Janssen portrays George Beckwith, a newspaperman who is opposed to U. S. action in Vietnam.

The film covers the selection of members of the A team and, during a press conference at Fort Bragg, Janssen condemns our participation in Vietnam. Wayne informs him that if he really wants to know what is going on, he should go there and see first-hand.

The plot then evolves around Janssen going as suggested, Wayne and his team following, and the conflicts of man, newspaper and war. The movie is expected to be released next spring.

It opens with a mass flyover of Hueys, which was filmed at Fort Rucker in October. Location filming was completed in November with only a few Hollywood scenes to be shot.

Wayne has indicated that he feels the public needs to be told the story of Vietnam and our involvement there. He hopes his film will help tell this story.